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CONTENTS

Rating the Department, *by Hugh Norris* 133
Developing Individual Tests, *by Max S. Henig* 137
An Inspection Department, *by Arthur W. Fountain* 138
A Code of Ethics, *by William L. Hunter* 142
The Hobby Fair, *by Max Chambers* 143
Junior-High Printing Tests, *by Harold H. Kirk* 144
Common Woodworking Tools — VII, *by E. M. Wyatt* 145
The Machinery of Daily Life, *by Laurence Parker* 148
Editorials 150
Unglazed Pottery, *by R. H. Jenkins* 152
Casting in the School Shop — III, *by N. A. McMillan* 153
Small Electrical Transformers, *by T. C. Lloyd* 154

Supplements

Airplane Landing-Gear Fitting, *by A. P. Lantis* ..... No. 310
Colonial Hanging Wall Bookshelf, *by Franklin H. Gottshall* ..... No. 311

Problems and Projects

Airplane Landing-Gear Fitting, *by A. P. Lantis* 157
Colonial Hanging Wall Bookshelf, *by Franklin H. Gottshall* 157
Socket Wrenches, *by F. N. Newton, Jr.* 158
Bird-Feeding Shelter, *by John H. Hills* 158
A Three-In-One Boat, *by Leonard Wright* 159
An Aluminum Weather Vane, *by M. V. Churchill* 161
Some More About the Co-operative Vacation School, *by H. H. Braucher* 163
Hopi Tihus, *by W. Ben Hunt* 163
Table Lamps and a Candlestick, *by C. R. Wells* 165
Tennis-Racket Repair Clamp, *by D. E. Kellogg* 165

Associations, Conventions 8A
Personal News 12A
News Notes 19A
Summer School News 15A
School Shop Equipment News 16A

THIS ISSUE

May is requisition time in many school systems. There may not be much money available for making purchases, hence the necessity of greater care in making out the requisitions. An editorial on the necessity of carefully planning these requisitions will be found in this issue.

Another editorial which may be helpful as a necessary check list by the shop teacher who will shortly be engaged in bringing his work to a close for the school year 1934–35 has been made a part of the offerings presented this month.

The articles on "Rating the Department," by Norris, "An Inspection Department," by Fountain, and "Small Electrical Transformers," by Lloyd, will be found especially helpful and interesting.

Among the problems and projects that deserve special mention are "Unglazed Pottery" by Jenkins, "The Colonial Hanging Wall Bookshelf," by Gottshall, "An Aluminum Weather Vane" by Churchill, and "Hopi Tihus" by Hunt.

THIS MONTH'S COVER

The cover picture this month shows students at work in the auto department of the Hadley Vocational School, St. Louis, Mo. Photograph submitted by A. B. Jordan, head of the automotive department.

Articles Indexed—The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."

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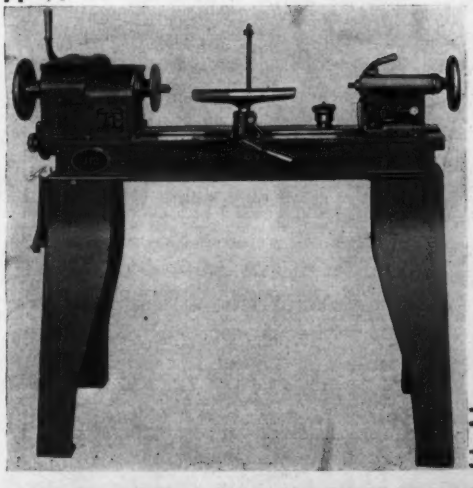

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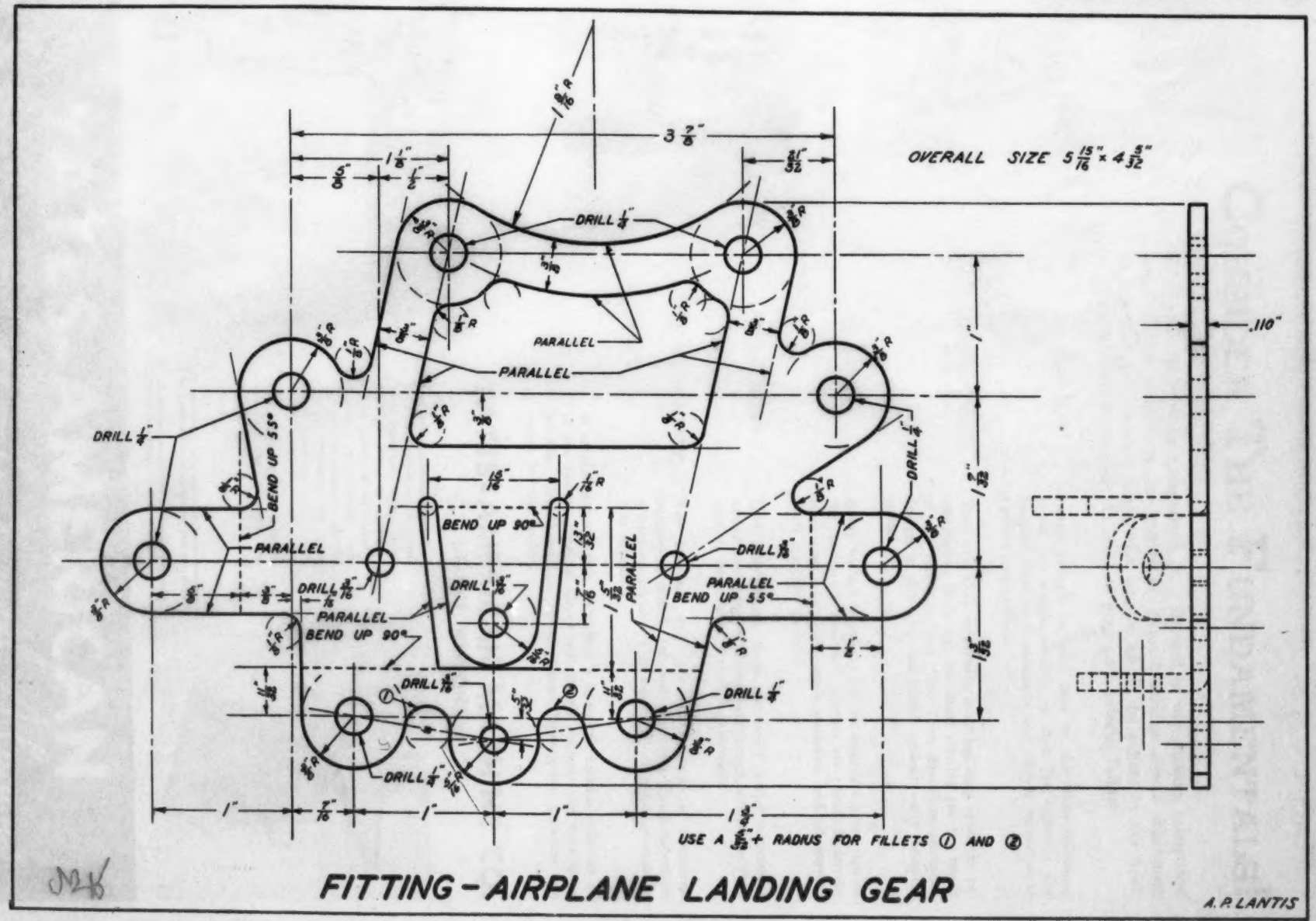

Designed by A. P. Lantis, Rantoul, Ill.

(This article is described on page 157)

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(This article is described on page 157)

TRACING SUPPLEMENT No. 311, May, 1935
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

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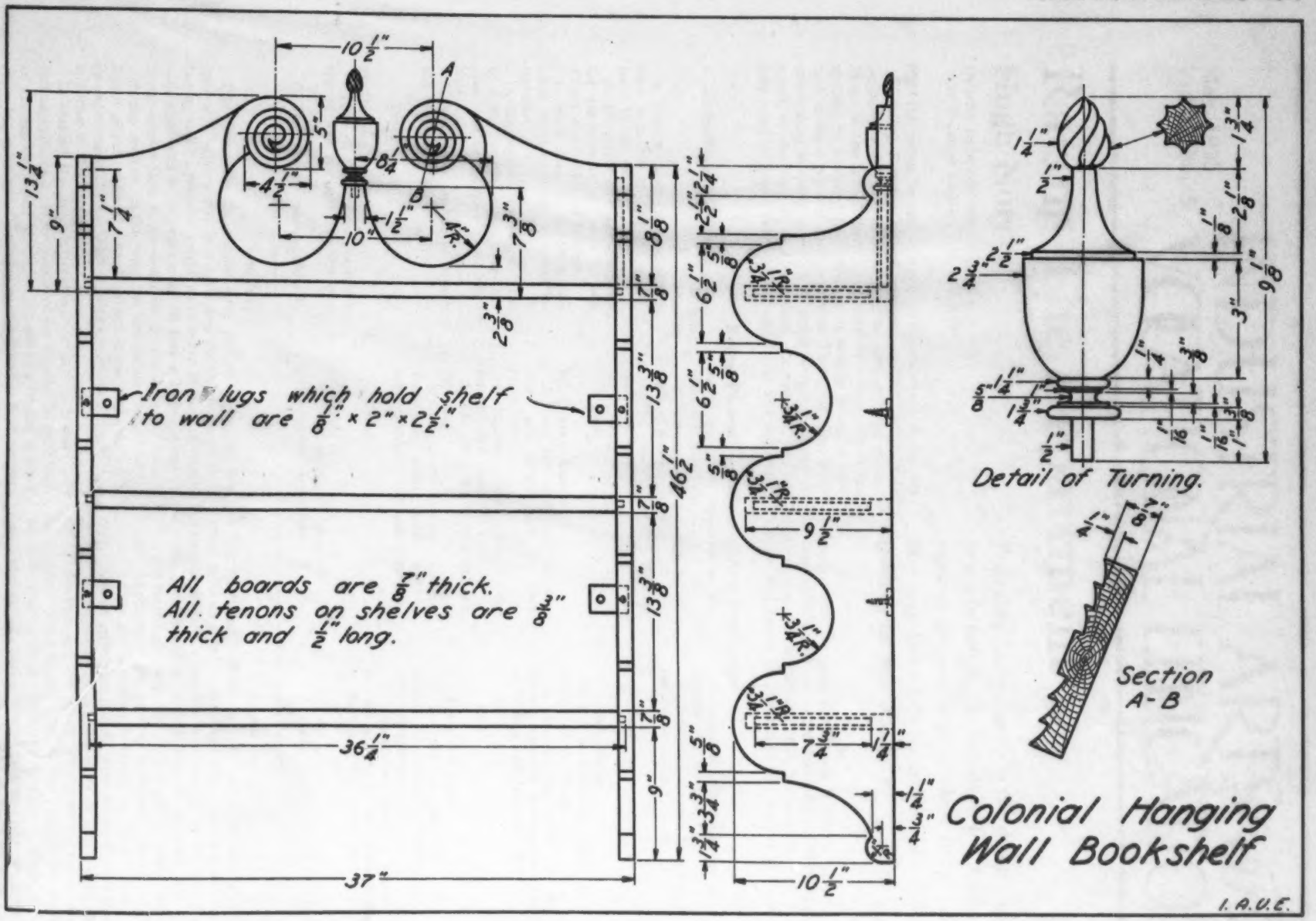
Iron lugs which hold shelf to wall are 1/8" × 2" × 2 1/2".
All boards are 7/8" thick.
All tenons on shelves are 3/8" thick and 1/2" long.
Detail of Turning.
Section A-B
Colonial Hanging Wall Bookshelf
I. A. V. E.

Designed by Franklin H. Gottshall, Scotch Plains, New Jersey

(This article is described on page 157)

May, 1935
Vol. 24, No. 5

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Rating The Department

Hugh Norris

Director Industrial Arts Education,
State Teachers College, Ada, Oklahoma

The rating factors set up in this article may be use in judging the industrial-arts department of a school or of a school system, or they may be used by the individual teacher in rating his own shop.

THE rating factors herewith presented, were set up for rating industrial-arts departments. Other factors may probably be devised which will give the same or better results. Many of the factors listed are general in nature; others are specific. In a study of this kind, it is usually better to have both of these types of factors present. Then, too, there is an overlapping in many cases, all of which is very necessary in a task of this kind. It may be noticed, for instance, that the jury rated the pupils only 9 points out of 100. In other words, it appears that the pupil is only one fourth as important as the administrative phases of the department. The truth of the matter, however, is that the child is connected with all the factors, and cannot be confined to but one set of them.

Rating Factors for Industrial-Arts Department

	Weighted Ratings
I. Administrative in Nature:	
A. Definite aims and objectives have been set up and are understood by the teachers	15
B. The salary scale, and provisions for advancement are such as will attract and hold good teachers	12
C. Work done for the institution often interferes with classroom instruction	4
D. The morale toward this type of work, by the student body and other faculty members, is rated high	3
E. An efficient system of records and accounts is used	3
Total	37
II. Teaching Forces:	
F. The teachers are especially trained and equipped for this type of work	12
G. The teachers' mental, physical, moral, and social characteristics are adapted to this work	5
H. The teachers are alive to the needs of self-improvement	4
I. The teachers believe in their work and enjoy it	3
Total	24
III. Physical Equipment:	
J. Space and equipment are adequate and suitable for the work being done	4
K. Materials and supplies are plentiful and always at hand	4
L. The shops are well lighted and ventilated	3
M. Adequate locker space for students — for wraps, books, and to store materials under construction	3
Total	14
IV. Pupils:	
N. The student's initiative and originality are encouraged	3
O. Individual differences are recognized and provided for	3
P. Individual students progress as rapidly as possible	3
Total	9
V. Subject Matter:	
Q. Life activities are utilized as a portion of the work	5
R. The subject matter in the various courses is arranged in order of learning and doing difficulties	4
Total	9
VI. Extracurriculums:	
S. The teachers take an active interest in churches, lodges, and civic organizations	4
T. The teachers take an interest in boys outside of the schoolroom, in the way of boy scouts, etc.	3
Total	7
Grand Total	100

The Jury

The ratings for the factors were arrived at by the jury method. The jury met in a body and openly discussed each factor, and its relative weight as to other factors. A round-table discussion of this nature by the jury is likely to lead to better results than if the members do not come in contact with one another. In this way, the factors are "aired" to the fullest extent, while without discussion many good points will go unobserved. The exchange of views is bound to be helpful in a case of this kind.

In making the weighted ratings, the jury had many and various opinions as to the values of the factors. In each case, an average was struck. It was a give-and-take feeling in many cases, but in the end, all parties were satisfied as to the ratings as a whole and were willing to make the concessions.

Questions

The questions that go with the factors in this paper are aimed to draw out the individual phase of the work, and to make the individual teacher take note as to his own opportunities and the way he is interested in his work. The questions are stated in a way that it is hoped to make the staff in this department think, and not to cause a reaction that the person asking the questions is trying to "pick" fault. The main thing to remember is that these rating factors show a method of measuring an industrial-arts department by showing up the high and low points. The questions set up should be answered with a simple "yes" or "no." Should the majority of these answers be in the negative, there is likely to be a low rating on this factor, while if the majority are answered in the affirmative, the factor being rated will be scored high.

These are not the only questions that can be taken under consideration. There might be a set of questions made to go with any other factor or factors. The questions proposed are both general and specific in nature. Many of them will not fit into all systems, although they are general enough to fit most programs. They also can be used by the teacher to rate his own shop or department. This may be done annually, and the results charted.

The Factors

I. Administrative in Nature

A. Aims and Organization

1. Do the teachers fully understand the aims of the courses that are offered in this department?
2. Is there a certain educational philosophy pertaining to this type of education, and is it understood by the administration, the supervisor, and the teaching staff?
3. Is there a course of study made out in advance for each subject and grade in this department?
4. Does each teacher in this department have his work well planned and organized in advance?
5. Are the plans, as worked out, carried out with a degree of satisfaction to all parties concerned?
6. Is the planning and organization in keeping with other departments in the institution?
7. Is it understood by the administration, staff, and patrons that the work is nonvocational, or that it is vocational?

B. Salary

1. Is the salary scale in this department equal to that paid in other departments in the institution?
2. Is the salary paid in this department equal to that paid in other schools in surrounding territory?
3. Is there a feeling of dissatisfaction among the teachers in this department as to their incomes as teachers?
4. Is the salary increase rapid enough, in the early stages, to hold and encourage young and growing teachers to stay with the department?

C. Repair and Maintenance Work

1. Is this department looked upon as a repair department for the institution?
2. Are the members of the staff called upon to do technical work when an experienced workman should be called in?
3. Does the administration ask the teachers, and the students, in this department to make things for the personal use of the officials?
4. Do fellow teachers in other departments feel that it is all right, and is expected, for this department to make things for the personal use of the other teachers?

D. Status of the Work in the School

1. Are the members of the staff in this department received on the same level professionally, educationally, and socially as other members in other departments?
2. Is this type of work looked upon as suitable for pupils with a low I.Q. and not for those with a high I.Q.?
3. Is this work looked upon as drudgery, and as a lower type of education?
4. Do the projects made in this department have an artistic appearance, and are they well designed?
5. Is the quality of workmanship equal to that done by other departments in the institution?
6. Are the classes large enough to add interest, and give an incentive for the best working conditions?
7. Are the classes too large to be accommodated with the regular equipment and supplies in the department?
8. Is there a tendency to crowd students into this department because of the nature of the work?

E. Records and Accounting

1. When a project is completed by a student, is a record made and credit given?
2. Does the pupil pay the instructor, or does he make payment to the central office?
3. Are receipts given in return for all money received?
4. Are records kept of money paid out for supplies, and is this checked against the money received?
5. Is this department operated on a budget system, on the same bases as other departments in the institution?

II. Teaching Force

F. Training

1. Are the teachers in this department drawn from the various trades in the community?
2. Is the training of the staff in this department on an equal footing with that of other departments in the institution?
3. Have the members of the staff had regular training in colleges and teacher-training institutions in the fields of methods, psychology, languages, history, mathematics, and other general subject matter?
4. Are the members of the staff teaching subjects in which they majored while in training?
5. Are the members of the staff looked upon by other teachers in the institution as knowing their subjects?
6. Are there members of the staff that had other majors while in training, such as engineering, mathematics, history, but found *wages* somewhat lower in these fields, and changed over to this department without professional training, or technical knowledge of the subject matter in this field?

G. Fitness for Work

1. Are the individual members of the staff physically fit for the work required of them?
2. Do the teachers of this department have other interests that take their time out of class hours?
3. Do the teachers in this department give extra time in preparation for classroom duty?
4. Are there members of the staff that refuse, or hold back from doing work that has to be done?

H. Professional Advancement

1. Are the teachers in this department members of the state organization of teachers?
2. Do the teachers in this department take advantage of books and magazines that are published in their field?
3. Are the members of the staff taking advantage of advancing themselves by studying during vacation?
4. Are the members of the staff, while on the job, taking advantage of the various courses that are offered by correspondence and extension?
5. Are the members of the staff working during vacations at various occupations, to improve their knowledge in their field, or do they work for financial gain alone?

I. Professional Attitude

1. Do the staff members, as a whole, believe that their work is just as important, as cultural, and will function in life the same as other subjects studied in the school?
2. Do the members of the staff seem to receive the same amount of enjoyment, from their teaching, as do the members of other staffs in the institution?
3. Do members of the staff remain after class hours to give aid to interested students?
4. Do members of the staff dismiss all school duties as soon as the class periods are over?

III. Physical Equipment

J. Space and Equipment

1. Is the equipment in this department old and out of date?
2. Is the equipment in a good state of repair?
3. Is the equipment sufficient for the number of pupils that are enrolled in this department?
4. Is the floor space adequate for the number of students in this department?
5. Do the students have to use equipment that was intended for other types of work?

K. Materials and Supplies

1. Does the head of the department, or staff, have to furnish supplies from his own resources?
2. Are supplies ordered in advance, and paid for by the institution, just as for other departments?
3. Is there adequate storage room for all supplies?
4. After the orders have been placed for supplies, and emergencies arise, how are these needed items obtained?

L. Lighting and Ventilation

1. Is this department situated in the basement, probably below the grade line, with poor lighting and ventilation?
2. Are classroom facilities on a par with other departments in the institution?
3. Are the rooms situated under an old boiler room, or in rooms discarded by other departments?
4. Is the floor and wall structure well waterproofed, and is the department free from dampness?

M. Lockers

1. Are the lockers built in, or of a

temporary nature?

2. Is there individual locker space for each subject taught in this department?

3. While the projects are under construction, are they stacked about the edges of the shops in an unsightly way?

IV. Pupils

N. Encouraging Initiative

1. Are the courses in this department so planned in advance that the student's initiative and originality are limited to a great extent?

2. Are the students encouraged to offer suggestions and plans for their own problems?

3. Are the pupils allowed to make selections of projects with the consent of the instructor in charge?

4. Are home projects, of interest to the pupils, encouraged and do they receive help from the instructors?

O. Individual Differences

1. Are there provisions made for special students that might be enrolled in this department?

2. Are the pupils allowed to seek information from fellow students in class when the instructors are engaged?

P. Individual Help

1. Are there provisions made to take care of slow and fast students without interfering with classes?

2. Is it possible for the students to receive individual instruction, when needed, in this department?

V. Subject Matter

Q. Related Subject Matter

1. Is it possible for a student to make things that interest him, even if they are not part of the regular course of study?

2. Are seasonable activities encouraged, and do the students take advantage of these opportunities?

3. Do the teachers in this department use classroom methods equal to those used by the teachers in other departments of the institution?

4. Are the teachers definite in their plans when it comes to putting the subject matter over?

5. Do the pupils understand that the work is vocational, or nonvocational — that the work possesses cultural value — that it imparts information just as do the other courses offered by the institution?

R. Arrangement of Subject Matter

1. Is the subject matter arranged according to the learning and doing difficulties?

2. Is the subject matter so arranged that it will draw the student out, and be an incentive to go further into certain phases of the study?

3. Are the aims and objectives outlined to each class so that the pupils understand what is expected of them?

4. Do the pupils know that they are to pay for the projects, that the materials used are not free?

VI. Extracurriculums

S. Church and Civic Affiliations

1. Do the teachers in this department take an active part in church and Sunday-school work?

2. Are the teachers in this department active in the various community organizations?

T. Boy Interests

1. Are there any active scout masters among the teachers in this department?

2. Are there active club organizations in this department, extracurricular in nature, meeting outside of class?

How to Rate an Industrial-Arts Department

1. With the rating factors before you, answer each question, rating it on a value of 10. Take, for instance, under A: If definite aims and objectives have been set up, and are well understood by the teachers in the department being tested, give a rating of 10. If the majority of teachers understand these aims and objectives, a rating of 7 or 8 might be given. If but a few teachers understand the aims and objectives set up for their work, a rating of 2 or 3 would be given. Table I shows the ratings given in a survey of the industrial-arts department of a certain high school. The ratings are in the column under R.

Factors	Rating Given R	Weighted Coefficient W	R x W
A	10.0	15	150
B	3.0	12	36
C	10.0	4	40
D	8.0	3	24
E	5.0	3	15
F	10.0	12	120
G	5.0	5	25
H	10.0	4	40
I	10.0	3	30
J	7.0	4	28
K	10.0	4	40
L	10.0	3	30
M	1.0	3	3
N	10.0	3	30
O	10.0	3	30
P	10.0	3	30
Q	10.0	5	50
R	9.0	4	36
S	10.0	4	40
T	7.0	3	21
Total	165.0	100	818

Weighted Efficiency $= \frac{R \times W}{1000} = \frac{818}{1000} = 81.80\%$

Direct Efficiency $= \frac{R}{200} = \frac{165}{200} = 82.50\%$

Table I. Computation of weighted efficiency

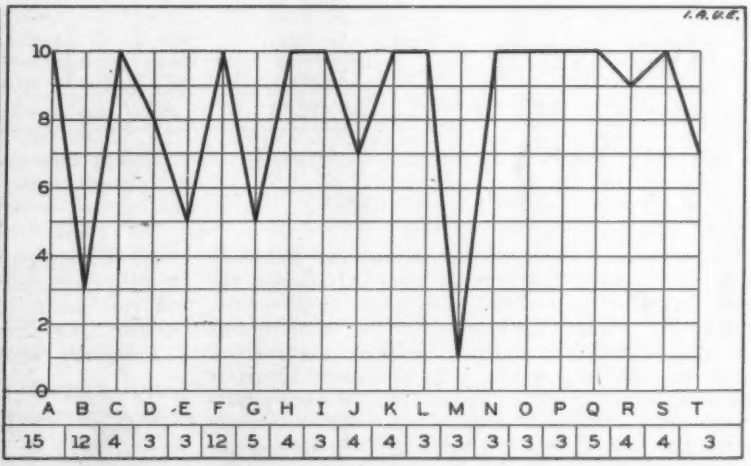

Fig. 1. The above curve is plotted on direct rating. The efficiency computed on the basis of the relative weights assigned to factors is 81.80 per cent

Since there are 20 factors, then the total possible rating would be $20 \times 10 = 200$. To get the direct efficiency of the department, then, add up the ratings given it under each of the factors and divide this total by 200. In other words, the direct efficiency is $\frac{R}{200}$ which for the high school in Table I equals $\frac{165}{200} = 82.50$ per cent.

To obtain the weighted efficiency rating, make use of the formula: Weighted efficiency $= \frac{\text{Total } (R \times W)}{1000}$. The divisor 1000 in this formula is obtained by taking the sum of the weighted coefficients, W, which is 100, and multiplying this by the common possible rating of the factors — 10. In other words, $100 \times 10 = 1000$. The weighted efficiency, therefore, equals $\frac{\text{total } (R \times W)}{1000} = \frac{818}{1000} = 81.80$ per cent.

The next step is to study the findings carefully and then to determine for each factor a maximum expectancy rating.

Factors	Rating Given R	Maximum Expectancy Rating R'	R' - R	Weighted Coefficient	(R' - R)W	"High" Improvement Points
A	10.0	10.0	.0	15	.0	
B	3.0	8.0	5.0	12	60.0	✓
C	10.0	10.0	.0	4	.0	
D	8.0	10.0	2.0	3	6.0	
E	5.0	9.0	4.0	3	12.0	✓
F	10.0	10.0	.0	12	.0	
G	5.0	10.0	5.0	5	25.0	✓
H	10.0	10.0	.0	4	.0	
I	10.0	10.0	.0	3	.0	
J	7.0	9.0	2.0	4	8.0	
K	10.0	10.0	.0	4	.0	
L	10.0	10.0	.0	3	.0	
M	1.0	8.0	7.0	3	21.0	✓
N	10.0	10.0	.0	3	.0	
O	10.0	10.0	.0	3	.0	
P	10.0	10.0	.0	3	.0	
Q	10.0	10.0	.0	5	.0	
R	9.0	10.0	1.0	4	4.0	
S	10.0	10.0	.0	4	.0	
T	7.0	7.0	.0	3	.0	
				Total	136.0	

It appears that certain factors need improvement much more than others. The four most important improvement points are indicated by check marks in the last column.

Weighted Efficiency of computed increase $= \frac{(R' - R)W}{1000} = \frac{136}{1000} = 13.6\%$

Table II. Computation of values determining "high and low" improvement points

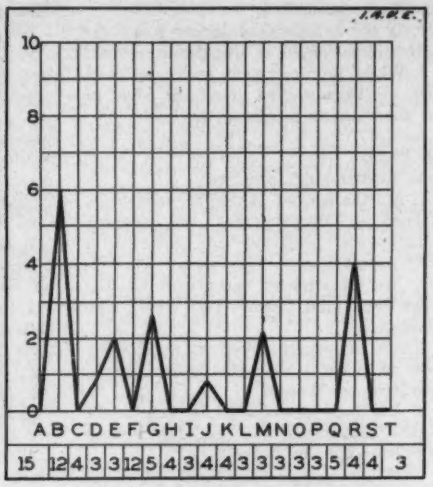

Fig. 2. In setting up the procedure for determining the improvement points both the weighting coefficients and a curve may be utilized in order to show what the industrial-arts department being rated might be expected to attain

Factors	Rating Given R	Weighted Coefficient W	R x W
A	10..0	15	150
B	8.0	12	96
C	10.0	4	40
D	10.0	3	30
E	9.0	3	27
F	10.0	12	120
G	10.0	5	50
H	10.0	4	40
I	10.0	3	30
J	9.0	4	36
K	10.0	4	40
L	10.0	3	30
M	8.0	3	24
N	10.0	3	30
O	10.0	3	30
P	10.0	3	30
Q	10.0	5	50
R	10.0	4	40
S	10.0	4	40
T	7.0	3	21
Total	191.0	100	954

Weighted Efficiency $= \frac{R \times W}{1000} = \frac{954}{1000} = 95.4\%$

Direct Efficiency $= \frac{R}{200} = \frac{191}{200} = 90.55\%$

Table III. Computation of weighted efficiency and increase efficiency

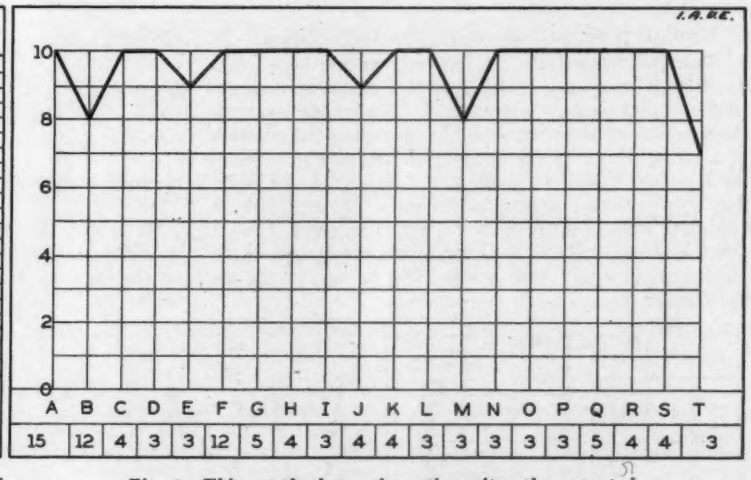

Fig. 3. This graph shows the rating after the expected improvements suggested have been made

While for some of the factors the maximum goal of 10 may be put down, nevertheless there are others which under the conditions existing may be beyond the power of the department itself to change. The improvement in factors such as these must therefore be carefully considered and probably ratings such as 7, 8, or 9 be assigned to these factors as maximum expectancy ratings. Table II shows these expectancy ratings, R', that were assigned for the high school whose ratings appear in Table I. As shown in Table II, both the ratings given, R, and the maximum expectancy ratings are arranged in adjacent columns. From the values in these two columns, then, the differences $(R' - R)$ are obtained by subtraction and placed in the fourth column. The weighted efficiencies shown in Table I are then placed in the fifth column and the product $(R' - R)\,W$ are obtained by multiplying the quantities in columns four and five. The check marks in the last column of Table II show the factors that need the greatest improvement.

An efficiency graph is then constructed like the one shown in Figure 1. This presents a picture which clearly indicates the weak points which need strengthening to improve a given industrial-arts department.

Calculating the weighted efficiency by the formula:

$$\frac{(R' - R)\,W}{1000} = \frac{136}{1000} = 13.6 \text{ per cent,}$$

which shows the percentage of improvement that might be expected in this department.

Figure 2 shows the results of Table II graphed. In Table III the weighted efficiency and direct efficiency have been calculated, taking for granted that the improvements indicated in Table II have actually been accomplished. The method used is the same as that applied in Table I. The graph in Figure 3 indicates pictorially the results obtained in the department by making the suggested improvements.

Developing Individual Tests

Max S. Henig

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The author calls attention to the factors which underlie the development of informal objective tests to be used with individual instruction sheets.

IDEAL teaching results may well be considered to have been obtained when the student not only remembers the subject matter of the various assignments which he has covered, but also evidences that he has understood and organized this material so that he can apply it properly when the occasion arises. Systematic testing is the only practicable device that measures the extent to which these teaching products have been achieved. This applies whether the instruction has been given by the individual lesson-sheet method or by the procedure used in the traditional classroom. The formulation of pedagogically valid tests for the latter system has recently been shown to be dependent upon the mastery of a complicated technique. The very nature of the individual instruction-sheet method argues that the development of tests suitable to this method will require at least as complete a mastery of the testing technique.

Recall Tests Should Have Educational Value

The formulation of such individual test sheets presents a whole series of problems. The easiest section to set up is that planned to test the student's knowledge of the subject. Even here one needs to guard against unduly simplifying the test. The questions, if possible, should not be identical with those that appeared on the assignment sheets. If this cannot be avoided, they should at least be put into new combinations to compel the student to make a corresponding rearrangement of his stock of ideas. "List the important problems arising from the rapid growth of cities. Explain fully for any one of them, how it is produced by the city's quick growth" typifies one form these questions or problems may take. The pupil is thus encouraged to feel he is making progress even while taking a test. So administered, testing is also teaching.

Testing to Induce the Discovery of Relationships

An excellent test question is that which requires the student to prove that he not only remembers the material but actually understands its significance. Questions of this type are framed so that the student is given the opportunity to discover the relationship among various items of information. "Explain why the educated worker is less likely to meet with accidents than the uneducated worker," and "List the various stages of industrial development. In which stage were the people of the Old Testament? In which, the North American Indian at the time of Columbus? In which, the people of western Europe at the same time?" are examples of this type of question. They compel the student to cull from his stock of knowledge only the pertinent facts and to consider these facts from a fresh angle, one that may reveal those items that are interrelated and bear upon the problems these questions present.

Testing for Ability to Apply Information

Of still greater significance pedagogically is the test question based, say, on some news item that gives the student the opportunity actually to apply the information he has acquired in school to his own problems or those of his community. The following questions exemplify this type: "One of this country's greatest industrialists advises young men to spend all their money for self-improvement till they are earning so much they can't spend it all. Do you think this good advice? Explain your answer," and; "Show how the use of credit makes it possible for the neighborhood store successfully to compete with the chain store." They compel the student to consider the information the textbook or the information sheets have presented in an entirely different light, that of his own or his parents' or his friends' experiences. Test questions like these reveal to the pupil that the school can contribute helpfully in the everyday affairs of his world, and give him the chance, also, if not to participate in these affairs, at least to arrive at a sound attitude toward them. Test sheets so formulated play a definite part in the teaching process.

Making the Test Economical of the Students' Time

Rather obviously, the ideal test sheet, one that would examine the student's ability to remember subject matter, to apprehend it, and to apply it to his extra-mural interests and activities would consume in every instance an inordinate amount of his time. This obstacle can be avoided in either of two ways: (1) by making the section of the test devoted to the determination of the student's ability to recall subject matter, a résumé or a sampling of the material; or (2) by formulating this content-testing section of the sheet as an informal objective test. This device has been so extensively used lately, the literature is so easily accessible, that only its major advantages in connection with the problem of the self-administered test sheet need here be presented.

The Objective Test and Its Advantages

The first advantage of the informal objective test is its definiteness. The questions, among which, named according to their form, are the multiple choice, true-false, completion, matching, and yes-no type, are so framed that each answer, almost invariably consists of just one word. Another advantage is its efficiency as a timesaver in both the taking and the rating. This also is achieved by the call for the single word in contrast to the essay form of answer.

By this device, every important element in the content of any series of lessons can be tested in an amazingly short time and with comparatively little drain upon the student's energies. Thus freed from the fatiguing effect that results from the essay form of tests, he is left in much better mental condition to attack the other types of questions posed by the test sheet.

Objective Tests Difficult to Formulate

It is, however, fitting and advisable to remark in closing this phase of the topic, that whereas the taking of an informal objective test imposes only a slight strain, the same does not hold true of formulating them. Several difficulties are inherent in the objective test. The simplest for the inexperienced teacher to surmount is the selection of the various items of the content for which to test. The only warning that experience indicates as necessary is that against being tempted by the amount of ground the student can easily cover by this type of test to use for testing purposes items of secondary and even less than secondary importance. One way to avoid this fault is to base these questions, so far as possible, on the faults revealed by the daily recitation. The other problem is much more troublesome. It is an attribute of the "true-false" and the "yes-no" type of question, and consists of the difficulty in avoiding the inclusion of questions that do not permit such unqualified answers. Actual experience alone can prove the onerousness involved in surmounting these problems. On the other hand, the ease of rating this type of test in itself compensates entirely for the labor of evolving it.

Individual Instruction Sheets Put Premium on Effective Tests

The advisability of interspersing the various learning levels comprised within the several related and nonrelated courses with properly formulated test sheets is obvious. They are the mortar that binds and unifies the structure. Their value is actually greater in the individual sheet type of teaching than in the traditional procedure since, of necessity, by the former method the review and drill inseparable from regular recitations are reduced in frequency and intensity. This potential value can be realized on fully by including after each learning level throughout the course individual test sheets, in every detail technically correct in formulation.

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An Inspection Department

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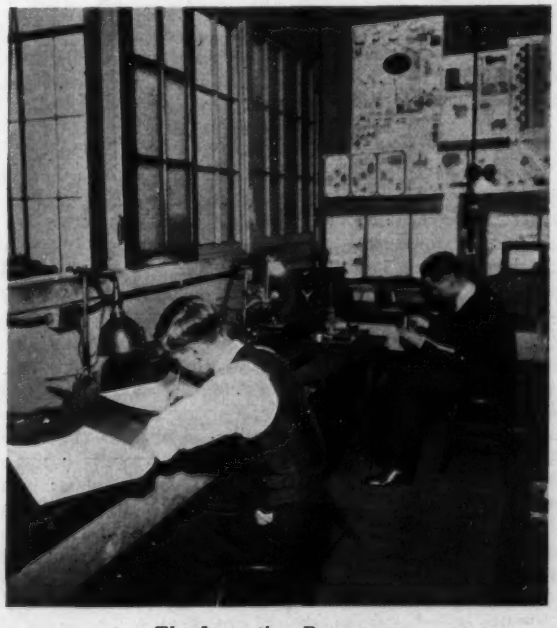
Another method which makes the work in the school shop more efficient while freeing the teacher to do a proportionally greater amount of teaching.

THE Cass Technical High School of Detroit, Michigan, for the past four years has been operating and experimenting with an inspection department, in conjunction with the lathe course in machine-shop work given in the school. This department has seemed to prove its worth both from the standpoint of what the student gets out of it, as well as the fact that it relieves the teacher of the necessary duty of appraising and grading the students' work, consequently allowing more time for actual teaching and supervision. Educators from various sections of the country have viewed with delight the workings of the inspection department and have expressed a hearty approval of it.

The Inspection Room

The inspection room in our particular shop is located at one end of the machine shop and was not included in the regular building plans, but was built in by students regularly enrolled in the School of Trades, a part of the Detroit school system. The room measures about 9 by 18 ft., and has swinging windows across its front which open out into the shop, thus providing a clear vision of the entire machine shop. The available wall space of the inspection room is covered with all sorts of inspection data, and pictures of inspection tools. Many of these show and explain the various uses of the tools. A chart, which we have chosen to call the "Inspection Reference Chart," containing practically all of the data necessary to the inspection of a piece of work, is in this room, and is the standard by which all work is inspected.



The Inspection Department

The Equipment of the Inspection Room

Heavy workbenches run along the front wall just below the swinging windows and also along the side wall. Other equipment is as follows:

6 Short stools
1 Large steel locker (used for all small inspection tools)
2 Small steel lockers (used for storing work awaiting inspection)
3 Adjustable bench lights
2 Surface plates (12 by 14-in.)
1 8 by 36-in. bench centers
1 Dial test indicator
1 Bevel, improved
1 Bevel, universal
1 Combination set
1 4-in. Caliper, inside
1 4-in. Caliper, outside
1 6-in. Caliper, outside thread
1 10-in. Caliper, vernier
1 6-in. Divider
1 2-in. Divider
1 Electric etching machine
1 Gauge, center
1 Gauge, drill grinding
1 Gauge, engineers taper
1 Gauge, Morse taper plug and ring, No. 3
1 Gauge, Morse taper plug and ring, No. 2
2 Gauge, fillet or radius
6 Gauges, plug; ⅝, ¾, ⅞, 1, 1⅛, 1¼-in. NOTE: The plug gauges are of the Go and No Go variety. There are ten gauges to each set, ranging in size by variations of .0005 in. The gauges run from .005 in. under the decimal-equivalent size, to .005 in. over the decimal-equivalent size. These gauges were turned, marked, hardened, ground, and lapped in our own shops.
1 Gauge, surface
1 Gauge, telescope
1 Gauge, vernier height
1 Gauge, screw pitch (for sharp V threads)
1 Gauge, screw pitch (for American National threads)
1 Gauge, adjustable thread tool grinding (for American National threads)
1 Gauge, adjustable thread tool grinding (for acme or worm threads)
1 Glass, pocket magnifying
1 Glass, reading
1 Indicator, dial test
1 Indicator, ideal
1 Knee, toolmakers adjustable
1 Micrometer, 1-in. graduated to read tenths of a thousandth
1 Micrometer, 2-in. graduated to read tenths of a thousandth
1 Micrometer: Set, 0 to 6-in., in wooden case
1 Micrometer, test plugs, set of 6
1 Micrometer, 1-in., 8 to 13 pitch (for measuring screw threads)

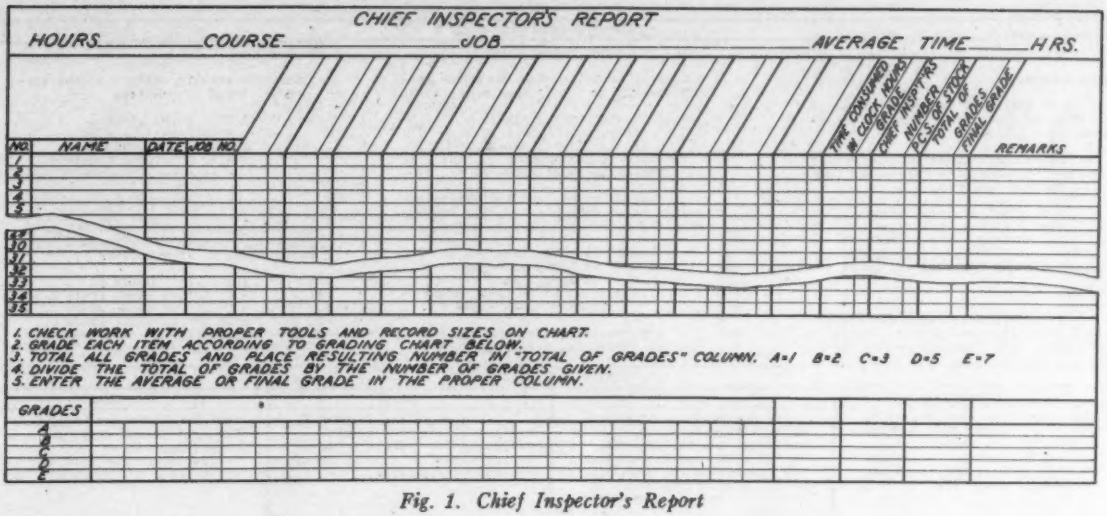

CHIEF INSPECTOR'S REPORT
HOURS COURSE JOB AVERAGE TIME HRS.
NO. NAME DATE JOB NO.
TIME CONSUMED IN CLOCK HOURS
GRADE CHIEF INSPECTOR'S
NUMBER P.C.'S. OF STOCK
TOTAL OF GRADES
FINAL GRADE
REMARKS
1. CHECK WORK WITH PROPER TOOLS AND RECORD SIZES ON CHART.
2. GRADE EACH ITEM ACCORDING TO GRADING CHART BELOW.
3. TOTAL ALL GRADES AND PLACE RESULTING NUMBER IN "TOTAL OF GRADES" COLUMN. A=1 B=2 C=3 D=5 E=7
4. DIVIDE THE TOTAL OF GRADES BY THE NUMBER OF GRADES GIVEN.
5. ENTER THE AVERAGE OR FINAL GRADE IN THE PROPER COLUMN.
GRADES
A
B
C
D
E

Fig. 1. Chief Inspector's Report

- 1 Micrometer, 2-in., 8 to 13 pitch (for measuring screw threads)
- 1 Protractor, improved universal bevel
- 2 Micrometers, inside
- 1 Rule, 24-in., beveled edge
- 1 Micrometer, depth
- 1 Rule, depth
- 1 Sine Bar, 5-in.
- 1 Solid steel square, 6-in. blade
- 1 Straightedge, 24-in.
- 1 Set V blocks and clamps
- 1 Vernier, gear tooth
- 1 Set of thread-measuring wires
- 1 Angle gauge
- 1 Fixture for holding thread-measuring wires
- 1 Bookcase containing books on shop practice, catalogs, and magazines

NOTE: Special gauges which were made in our shops were not included in this list.

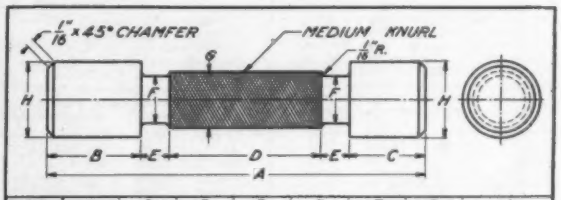
The inspection room, at the present time, is confined almost entirely to the inspection of lathe work, since the shop in which it is located is a lathe shop. It is proposed to install another inspection department to be used in connection with our other machine shop, where more advanced work on milling machines, shapers, planers, grinders, etc., is done.

The Record Form

The record form used in connection with the inspection department is printed from a 9 by 18-in. Van Dyke, in our drafting department. These forms have a white background with blue lettering and lines. A sample form is printed herewith so a better understanding of it may be had. (Fig. 1.) It will be noted from the copy that we have chosen to call this form the "Chief Inspector's Report." One of these blanks is necessary for each job in the course and for each class. One is also used as a semester record. If there were ten projects or jobs in the course, it would be necessary to make out ten sheets, plus one which is to be used as the semester record, or a total of eleven sheets per class. These records are kept entirely by students in the inspection department, that is, after the teacher has entered the headings at the top of the sheet and set the limits at the bottom. All sheets are completely made out in ink.

Preliminary to the Actual Inspection

Before the inspectors can actually start to inspect and record the work, the chief inspector's report blank must be made out. The students assigned to the inspection room enter all the names of their classmates in exact alphabetical order, as shown under the name column. They also enter the work number in the column provided. The work number may be an arbitrarily chosen number, or it may be systematized, as we have done. In our shop, the work number is the class period followed by the student's lathe number, with the exception of lathes numbered from 1 to 9. For example, 5609 would mean that the student was in the fifth- and sixth-hour class, and his lathe number was 9. The number 5629 would mean that the student was in the same class and his lathe number was 29. It will, perhaps, be apparent why the naught is inserted between the numbers from 1 to 9. It prevents trickery which invariably prevails among a group of students.



NO.	A	B	C	D	E	F	G	H
1.	4"	1/8"	1/2"	2 1/2"	1/2"	1/2"	1/2"	1/2" + .015
2.	4 1/2"	1/4"	1/2"	2 1/2"	1/2"	1/2"	1/2"	1/2" + .015
3.	4 1/2"	1/8"	1/2"	2 1/2"	1/2"	1/2"	1/2"	1/2" + .020
4.	5"	1"	1/2"	2 1/2"	1/2"	1/2"	1/2"	1/2" + .020
5.	5"	1 1/2"	1"	2 1/2"	1/2"	1/2"	1/2"	1" + .020
6.	5 1/2"	1 1/2"	1 1/8"	2 1/2"	1/2"	1/2"	1/2"	1 1/8" + .020
7.	6"	1 1/2"	1 1/2"	2 1/2"	1/2"	1/2"	1/2"	1 1/2" + .020

NO.	OPERATIONS	TOOLS TO BE USED	SPEED	FEED
1.	CHECK STOCK FOR SIZE	6" STEEL RULE		
2.	FILE BURRS FROM ENDS OF STOCK	MACHINIST'S VISE, 10" MILL FILE		
3.	LOCATE AND CENTER-PUNCH ENDS FOR CENTER HOLES	CENTER HEAD, SCRIBER, CENTER PUNCH, HAMMER		
4.	DRILL CENTER HOLES. PLACE DRILL CHUCK IN HEADSTOCK OF LATHE	COMBINATION CENTER DRILL AND CHUCK, OIL	450-R.P.M.	HAND
5.	MOUNT WORK BETWEEN CENTERS. USE HALF CENTER IN TAILSTOCK	LATHE DOG, LIVE CENTER, HALF CENTER		
6.	SQUARE ENDS OF STOCK TO REQUIRED OVERALL LENGTH "A"	TOOL HOLDER, ROCKER, SIDE TOOL, 6" HOOK RULE	300-R.P.M.	MEDIUM 140
7.	LAY OFF ENDS "B" AND "C" TO THE REQUIRED LENGTH	COMBINATION SQ., SCRIBER, CENTER PUNCH, HAMMER		
8.	TURN HANDLE OF JOB "G" TO SIZE INCLUDING RECESSES	TURNING TOOL, TOOL HOLDER, OUTSIDE CALIPERS, RULE	300 to 400 R.P.M.	MEDIUM 140
9.	TURN RECESSES TO DIAMETER "F" AND WIDTH "E"	TOOL GROUND TO 1/16" RADIUS. RADIUS GAUGE	400-R.P.M.	HAND
10.	KNURL HANDLE OF JOB	MEDIUM KNURLING TOOL, OIL CAN	100-R.P.M.	COARSE 70
11.	TURN DIAMETERS "H" TO THE REQUIRED SIZE	TURNING TOOL, MICROMETERS	200-R.P.M.	FINE 280
12.	CHAMFER ENDS	R.H. SIDE TOOL, RULE	200-R.P.M.	HAND
13.	STAMP WORK NUMBER ON END OF JOB	1/8" STEEL FIGURES, HAMMER, ANVIL		I.A.V.E.

References-Advanced Machine Work by Smith-pages 223-226. Art. 52-62-page 1310. Fig 5 | GO and NO GO PLUG GAUGES | Job No. 114-B

Fig. 2

INSPECTION REFERENCE DATA

GENERAL DIRECTIONS

Dimensions.

The degree of accuracy expressed by drawing dimensions is to be interpreted as follows:

Fractional dimensions indicating ordinary measurements as usually taken with caliper and rule.

1/2 of 1/64" or less, grade A.
3/4 of 1/64" or less, grade B.
1/64" or less, grade C.
1-1/2 of 1/64" or less, grade D.
Exceeding 1-1/2 of 1/64" grade E.

Note.

It is suggested that the inspectors take all measurements, insofar as possible, with micrometers and Vernier calipers, in which case the above dimensions may be interpreted as follows:

.000 to .008" grade A.
.009 to .012" grade B.
.013 to .016" grade C.
.017 to .024" grade D.
Exceeding .024" grade E.

Decimal dimensions indicating precision measurements as usually taken with the micrometer or Vernier caliper.

±.001" or less, grade A.
±.002" or less, grade B.
±.003" or less, grade C.
±.004 to .005" or less, grade D.
Exceeding .005" grade E.

Angular dimensions expressed by degrees indicating ordinary measurements as usually taken with the universal bevel protractor.

± 1° or less, grade A.
± 2° or less, grade B.
± 3° or less, grade C.
± 4° to 5° or less, grade D.
Exceeding 5°, grade E.

Angular dimensions expressed by degrees and minutes indicating measurements as usually taken with the universal bevel protractor having a Vernier which reads to five minutes.

± 0° to 30', grade A.
± 1° 00' or less, grade B.
± 1° 30' or less, grade C.
± 2° 30' or less, grade D.
Exceeding 2° 30', grade E.

MAKING THE INSPECTIONS

PURPOSE.	METHOD	RESULT	REFERENCES
1. Diameter - Straight. (a) Testing the maximum concentric error for all work turned on centers or mandrel. Eccentric work indicates an untrue live center.	1. (a) Use bench centers and dial test indicator. Revolve the work mounted on the bench centers through one revolution for each diameter, with pressure of the indicator button on the work surface.	1. (a) The variation in the reading of the dial needle indicates the error. Grade by fractional or decimal dimensions as specified.	1. (a) See Bench Centers, Brown and Sharpe Catalog No. 30, page 429. Advanced Machine Work by Smith, pages 113 to 118.
(b) Testing the maximum parallel error with the work axis for all straight work turned on centers or mandrel. Work not parallel indicates an off-center position of the tail-stock setting, or wearing or moving of the cutting tool.	(b) Use bench centers and dial test indicator. With pressure of the indicator button on the work surface, move the indicator lengthwise and locate the maximum and minimum reading in the length of each diameter.	(b) The difference in dial readings divided by the length in inches apart indicates the taper per inch. Grade by fractional or decimal dimensions as specified.	Same as 1 (a)
(c) End and shoulder length error for all turned work. Such errors indicate a combination of 2 (a) and (b), and also in measurements.	(c) Test as in 1 (b) except that the dial is set to a standard-diameter plug gauge of the assigned-work diameter.	(c) The maximum error over or under is indicated by the dial-needle deviation from the standard. Grade by fractional or decimal dimensions as specified.	Same as 1 (a)
2. Lengths - Straight. (a) Ends and shoulders out of square with work axis. Out of square indicates facing error in the chuck, or live center out of true.	2. Use bench centers and dial test indicator. (a) Revolve the work on centers with pressure of the indicator button perpendicular to the squared end at the outer edge of the work.	2. (a) Note the variation on the dial. Grade by fractional or decimal dimensions as specified.	Advanced Machine Work by Smith, pages 129 to 132.
(b) Parallel error of squared ends and shoulders. Out of parallel indicates error in facing in the chuck, or tail-stock in off-center position.	(b) Use surface plate and dial test indicator. Rest the work on a surface plate with the work axis perpendicular to the plate. Set the dial at "0" on the outer edge and move across the diameter.	(b) Variation from "0" indicates convex, concave or out of parallel. Grade by fractional or decimal dimensions as specified.	Advanced Machine Work by Smith, page 1330.
(c) Testing the maximum diameter error for straight work turned on centers or mandrel. Errors indicate a combination of inaccuracies 1 (a) and (b), and also in measurements.	(c) Use surface plate, height gauge with indicator, and 1" standard. Set height gauge to 1" standard so needle of indicator rests at "0". Reset the height gauge for each assigned length and note the reading on indicator dial.	(c) The error in length is indicated by the + or dial reading considered from the original reference plane. Grade by fractional or decimal dimensions as specified.	Use of Vernier Height Gauge, L. S. Starrett Catalog. Advanced Machine Work by Smith, page 1249.
3. Knurling. (a) Knurling error for all work. Errors in knurling indicate incorrect method or manipulation.	3. (a) Compare with a full knurl of true pitch.	3. (a) Full and True Knurl, grade A. Slight flat or pitch error, grade B. Flat or pitch error, grade C. Double cut and flat, grade D. Reknurl, grade E.	Advanced Machine Work by Smith, pages 635 to 636. Machinery's Handbook, page 918. Machine Tool Operation by Burghardt, page 118.
4. Eccentric turned work. (a) Center-distance error. Error in center distance indicates inaccuracies of layout dimensions, or in drilling center holes.	4. (a) Use bench centers and dial test indicator. Mount the work on the successive pairs of work centers with pressure of indicator button against work surface, and note the actual difference in the dial reading at each end of the work.	4. (a) The error is the difference between the actual and the assigned-center distance. Grade by fractional or decimal dimensions as specified.	Advanced Machine Work by Smith, page 631 C.
5. Taper. (a) Angular error. (Taper per foot.) Error in the amount of taper per foot indicates inaccuracy in the set-up of the machine for machining.	5. (a) Use taper gauge set by disks for the correct angle, and check error with thickness gauges; or use sine bar set to the taper in hand and check error with Vernier height gauge.	5. (a) The error is the difference between the actual and the assigned taper per foot, or degrees. Grade by fractional, decimal or angular dimensions as specified.	Machinery's Handbook, pages 1030 to 1033. Advanced Machine Work by Smith, page 1264. American Machinist, page 566.
6. Threads. (a) Pitch-diameter error for external threads. (b) Angle error for external threads. (c) Lead error.			

Fig. 4. Part of inspection reference data chart

CHIEF INSPECTOR'S REPORT

HOURS 9TH and 10TH COURSE ONE JOB SEMESTER RECORD AVERAGE TIME ____ HRS.

NO.	NAME	DATE	JOB NO.	Cast-Iron Cylinder Grade	Bearings & Plates Grade	Go and No Go plug Gauge Grade	Spacing Collar Grade	Cast-Iron Gear Blank Grade	Stud Bolt Grade	Stud-Bolt Ring Grade	No. 1 Morse Taper Plug Gauge Grade	Lathe Spindle Bushing Grade	Lathe Centers Grade	Mic. or Spec. Jobs Grade	Mic. or Spec. Jobs Grade	Mic. or Spec. Jobs Grade	Time Consumed in Clock Hours Grade	Chief Inspector's Grade	Number of Pcs. on Stock	Total of Grades	Final Grade	REMARKS
1	Adler-Coleman		91028																			
2	Borella-Steve		91018																			
3	Busen-John		91021																			
4	Britton-William		91027																			
5	Berckowski-John		91017																			
	Edward		91005																			
	Thom...		91017																			
30	Van Vliet-...		91023																			
31																						
32																						
33																						
34																						
35																						

1. CHECK WORK WITH PROPER TOOLS AND RECORD SIZES ON CHART.
2. GRADE EACH ITEM ACCORDING TO GRADING CHART BELOW.
3. TOTAL ALL GRADES AND PLACE RESULTING NUMBER IN "TOTAL OF GRADES" COLUMN. A=1 B=2 C=3 D=5 E=7
4. DIVIDE THE TOTAL OF GRADES BY THE NUMBER OF GRADES GIVEN.
5. ENTER THE AVERAGE OR FINAL GRADE IN THE PROPER COLUMN.

GRADES	
A	
B	
C	
D	
E	

Fig. 3

The next step is for the instructor to determine what the job is to be inspected for, or what parts are to be inspected. It is apparent that some parts of a job would not require inspection while others would. For example: if the job happened to be the student's first one of turning between centers, the center holes would require a close inspection for diameter, depth, and smoothness, but later in the course the center holes would be given no more than a visual inspection because it is assumed that the student understands the absolute necessity of proper center holes.

It has been found advisable that the instructor fill out the headings of the chief inspector's report, and also the limits, as given at the bottom of the sheet. It will be necessary, however, to fill out only one sheet for each job in the course, since others may copy directly from the sample sheet. As time goes on, these sheets accumulate and can be copied, thus eliminating any work on the part of the instructor. The time required for the instructor to fill in his part of the chief inspector's report sheet is almost negligible compared with the time it would take him to give each job a thorough inspection.

It has been found expedient to use letters as dimensions on the drawings of some objects. The actual dimensions may then be tabulated as shown in Figure 2. This method assists in the inspection of the work, makes it possible to get along with fewer blueprints, and permits the instructor to assign different sizes of the same object to different classes.

Inspection Reference Data

The chart of inspection reference data, which has been previously mentioned, is a little too lengthy to print in its entirety, so a few items have been selected from it and listed here to give the interested some idea as to how the chart is arranged. The complete chart covers fairly well the field of inspection as ordinarily applied to turned work, including threading. This chart is intended to be a student guide and the standard by which all work is graded.

The chart of inspection reference data, shown in Figure 4, is the guide and standard by which all work is inspected. As previously mentioned, this chart is not printed in its entirety here.

Organization of the Inspection Personnel

At the beginning of a new semester, the instructor picks some student from the class who has shown up well in the preliminary instruction, or someone who has had previous shop experience, perhaps in an intermediate school shop, to act as the chief inspector. The student appointed as the chief inspector then picks his assistant. The first chief inspector appointed serves in the inspection room for one week at the beginning of the semester, and one week at the end of the semester. At the conclusion of each week, the assistant inspector becomes the chief inspector and he in turn chooses his assistant. It is thus apparent that each student picked for the inspection department serves for a period of two weeks,

CHIEF INSPECTOR'S REPORT

HOURS 9TH and 10TH COURSE ONE JOB GO and NO GO GAUGE (7/8") AVERAGE TIME 5 HRS.

NO.	NAME	DATE	JOB NO.	Diameter H Grade	Length B Grade	Diameter H Grade	Length C Grade	Overall Length A Grade	Width of Recess E Grade	Width of Recess Grade	Diameter F Grade	Diameter F Grade	Condition of Knurl Grade	Are Chamfers Uniform Grade	Finish Grade	Time Consumed in Clock Hours Grade	Chief Inspector's Grade	Number of Pcs. on Stock	Total of Grades	Final Grade	REMARKS
1	Adler-Coleman	11-9-34	91028	.894 A	1/16" D	.890 D	7/8" A	5" A	3/32" A	3/32" A	3/32" A	3/32" A	S.P.F. B	Yes A	C	7 D	91008	1	28	C	
2	Borella-Steve	11-14-32	91018	.894 A	1" A	.891 D	7/8" A	5" A	3/16" A	1/8" A	3/16" A	3/16" A	S.P.F. B	Yes A	A	7 D	91008	1	38	C	
3	Busen-John	11-14-32	91021	.894 A	1" A	.893 B	7/8" A	5" A	3/16" A	3/16" A	3/16" A	3/16" A	S.P.F. B	Yes A	A	7 D	91008	1	19	B+	
4	Britton-William	11-28-32	91027	.893 A	1" A	.891 B	7/8" A	5" A	3/16" A	3/16" A	3/16" A	3/16" A	S.P.F. B	Yes A	A	3 B	91008	1	16	B+	
5	Berckowski-John	11-14-32	91007	.894 A	1/16" E	.891 B	1 1/16" E	4 3/16" E	3/16" A	1/16" E	3/16" A	3/16" A	S.P.F. B	Yes A	A	5 C	91008	1	41	D+	
	Edward	11-14-32	91005	.897 D	1" A	.892 B	7/8" A	5" A	1/16" E	3/16" A	9/16" E	9/16" E	S.P.F. B	No E	D	7 D	91008	1	51	D	
29	Swaatz	10-31-34	91017	.893 B	1" A	.895 A	7/8" A	5" A	1/16" E	3/16" A	9/16" A	9/16" A	D.C.D.	No E	A	3 3/16 B	91015	1	31	C+	
30	Spearing-Lee		91023	.892 A	1" A	.892 A	7/8" A	5" A	1/16" A	1/16" E	.982 E	3/16" A	F.F.F. A	Yes A	A	4 C	91017	1	27	B	
31	Thompson-Bill				1" A	.892 A	7/8" A	5" A	1/16" A	1/16" E	.982 E	3/16" A	F.F.F. A	Yes A	A	4 C	91017	1	27	B	
32	Van Vliet-Harry	10-31-34	91037	.894 A	1" A	.892 A	7/8" A	5" A	1/16" A	1/16" E	.982 E	3/16" A	S.P.E. B	No E							
33																					
34																					
35																					

1. CHECK WORK WITH PROPER TOOLS AND RECORD SIZES ON CHART.
2. GRADE EACH ITEM ACCORDING TO GRADING CHART BELOW.
3. TOTAL ALL GRADES AND PLACE RESULTING NUMBER IN "TOTAL OF GRADES" COLUMN. A=1 B=2 C=3 D=5 E=7
4. DIVIDE THE TOTAL OF GRADES BY THE NUMBER OF GRADES GIVEN.
5. ENTER THE AVERAGE OR FINAL GRADE IN THE PROPER COLUMN.

GRADES	Diameter H	Length B	Length C	Overall Length A	Width of Recess E	Diameter F	Condition of Knurl	Are Chamfers Uniform	Time	Finish
A	.894 to .896	1" to 1 1/16"	1" to 1 1/16"	5" to 5 1/16"	1/16" to 1/8"	.982 to .984	Full and True	Yes	4½ Hrs.	Smooth finish by samples
B	.893	1" to 1 1/16"	1" to 1 1/16"	5" to 5 1/16"	1/16" to 1/8"	.982 to .984	Slight Error in Pitch		3 1/2 Hrs.	
C	.892	1" to 1 1/16"	1" to 1 1/16"	5" to 5 1/16"	1/16" to 1/8"	.982 to .984	Full or Pitch Wrong		3 Hrs.	
D	.890 to .891	1" to 1 1/16"	1" to 1 1/16"	5" to 5 1/16"	1/16" to 1/8"	.982 to .984	Double Cut and Flat		2½ Hrs.	
E	Reject						Reknurl	No		

Fig. 5. Chief Inspector's Semester Record

one week as the assistant inspector and one week as the chief inspector. By permitting the students to do their own choosing, it is believed that a more harmonious organization results.

How the Inspectors Work

In order to get a fair understanding as to exactly how the work of the inspectors is carried out, it is quite essential to view the procedure step by step.

1. The student, upon the completion of a project, presents it to the instructor who passes his opinion on the general appearance of the piece of work.

2. The student then takes this piece of work to the inspection-department window and presents it to the assistant inspector.

3. Immediately upon presentation, the assistant inspector records the date in the date column of the chief inspector's report and also observes that the student's work number is stamped on the end or face of the work. This number is then checked against the student's name. (See Figure 3.)

4. If the inspectors are not busy checking work, they invite the student submitting the work into the inspection room, and the actual work of inspection starts.

5. If the inspectors are engaged, the work is laid aside and the assistant inspector gives the student a requisition for his next piece of stock which he presents to the tool-crib attendant. Stock is handed out from the tool crib only upon presentation of a requisition from the inspectors or from the instructor.

6. The student whose work is being inspected is required to be in the inspection room during the inspection of his work. This assures him a fair deal and also shows him the process of inspection.

7. In case a piece of work does not pass inspection, the student making it submits it to the instructor who talks it over with him and attempts to give advice which will eliminate a recurrence of the same errors.

8. After the instructor and student have conferred over the piece of spoiled work, the instructor writes out a requisition for a second piece of stock, presents it to the assistant inspector, who in turn records on the chief inspector's report the fact that the student is getting his second piece of stock. The assistant then initials the requisition.

NOTE: When a student is given a second piece of stock, it drops his final grade on that particular job one grade. If his final grade on the second piece of stock works out to be an A, he automatically receives a B. This may seem a little peculiar but the results brought forth are astounding.

9. In the actual inspection of the work, the chief inspector does all of the measuring and testing. The assistant inspector does the recording. No figures or marks, aside from the date, are entered on the chief inspector's report until the job has been completely inspected and passed. All figures and grades are entered on a piece of scratch paper first. All dimensions, grades, and remarks are recorded in ink.

10. After a piece of work has been inspected and accepted, it is placed in a tote pan kept in the bottom of the inspector's tool cabinet, and kept under lock and key.

11. All work awaiting inspection is also kept in the inspection room in steel lockers and under lock and key.

12. All scrapped work is turned back to the tool crib with the requisition for a second piece of stock.

13. When a final mark has been arrived at, this mark is placed on the chief inspector's report (semester record) before the student leaves the inspection room. (Figure 5.)

What the Inspectors Do when not Engaged in Inspecting Work

The chief inspector and his assistant are always busy. When not engaged in inspecting some student's work, they must be looking forward to getting the record sheets made out for subsequent jobs in the course. When not doing this, they are required to familiarize themselves with the data around the walls of the inspection room, especially the inspection reference chart which naturally leads to many references to be found among the books and magazines contained in the bookcase of the inspection room.

Summary

We feel that the expenditure of both money and energy in equipping and organizing the inspection department is well worth while. The students, who, after all, are our main concern, are profiting in many ways. They are building up the foundation of a trade within a trade, namely, that of inspection; they are learning the necessity of accuracy in machine work; they are profiting from the drill received in the handling of precision tools; they become appreciative of the value of tools; they are learning to keep records accurately and neatly; they are learning to a marked degree the spirit of co-operation, and many other things almost too numerous to mention. They realize that the records which they are making are permanent, and may at some future time be the determining factor in their securing employment. They fully realize that the instructor is depending upon them to give each member of their class a fair and impartial inspection to his work, and also that any mistakes which they may make will undoubtedly be repeated by the instructor on the monthly marking of report cards, since his marks are made up from the chief inspector's report (semester record).

The work of the inspection department is truly one which demands trustworthiness and accuracy.

From the instructor's standpoint, the inspection department eliminates a lot of work which if carefully done would require that he be at his desk practically all of the time, and if carelessly done, it might better not be done at all. With the inspection department operating, the instructor is able to care adequately for more students per class, and is able to give more individual instruction to the students who require it.

A glance at any completed chief inspector's report sheet, readily shows up the weaknesses of a class or of a teacher. The completed sheet is a study in itself and well worth having and preserving.

It has been noticed during the time the inspection department has been in operation, that the percentage of scrapped work is lower.

A Code of Ethics

William L. Hunter

Iowa State College, Ames, Iowa

This code of ethics for teachers of industrial arts and vocational education, is the result of a conference attended by sixty-two experienced industrial-arts teachers at the Iowa State College, Ames, Iowa.

1. I will underbid no other teacher for a position which he already has, nor will I attempt by unfair means to secure a position which rightfully belongs to another.

2. Except in those schools where waiting lists of applicants are kept filed, I will apply only for positions which I have good reason to believe are open or vacant. Such application will be made to the superintendent of schools unless he designates some other person or body to whom application should be made.

3. I will state my qualifications for positions truthfully, and to the best of my ability will represent myself as I actually am.

4. I will sign a contract for a position only when I sincerely expect to fulfill my part of the agreement. In the event that a better position becomes available, I will secure an official release previous to signing a new contract.

5. I will support the superintendent, the board of education, the principal, or other officers of the school, so long as such support is primarily for the welfare of the pupils and the community. In case of disagreement with my immediate su-

perior, I will make every effort to bring about a mutual understanding before appealing to higher authority.

6. I will endeavor to be just as enthusiastic regarding the success of worthy fellow-teachers, superiors, and others as I am of my own. I will not recommend or in any way assist unqualified or undeserving persons in securing an industrial-arts teaching position; on the other hand, I will gladly assist all those who give promise of professional worth and integrity.

7. I will, insofar as possible, keep out of all petty religious, political, and community controversies; at the same time, I will aggressively work for and ally myself with any deserving cause or organization which gives promise of raising the standards of the industrial-arts teaching profession.

8. I will use my leisure time in improving myself educationally, physically, and culturally to the end that I may be of greater worth to the community which I am serving.

9. I will educate myself to use the English language, both oral and written, to the credit of myself and of the industrial-arts teaching profession.

10. I will endeavor to keep myself and my shop presentable at all times.

11. I will do my utmost to take proper care of tools, supplies, and equipment for which I am responsible.

12. I will use primarily for educational purposes any books, hardware, tools, or machinery which have been given to me by commercial concerns because of my connection with the school.

13. I will use school tools, materials, and equipment for educational purposes only.

14. I will present only those displays and exhibits which represent to the school patrons the important value to be derived from industrial-arts education.

15. I will earnestly try to live in such a manner that my standards and morals will not be questioned.

16. I will develop an interest in worth-while activities outside the range of my vocation, so as not to become a bore professionally.

17. I will give reasonable and appropriate publicity to such ideas and work as originate in my laboratory to the end that the industrial-arts teaching profession will be benefited and improved.

18. I will give appropriate and proper credit for all contributions and ideas of others which I use and which are of known origin.

19. I will strive to make my courses and my work so interesting, so integrated with general education, and so worth while that the place of the industrial-arts work in education will come to be properly recognized.

20. I will do my utmost to handle all financial matters, both my own and those of the department, in such a way that no one will question my integrity.

21. I will, to the best of my ability, fulfill the duties and obligations of an upright citizen of the community in which I live.

The Hobby Fair

Max Chambers

Preston, Maryland

In this, the sixth article on hobbies, the author describes the culminating effort — the hobby fair.

IT IS a great day in the lives of boys and girls that opens to them an opportunity to participate in a *hobby fair*. It is quite different from any activity ever offered them, because it exposes that part of boys and girls so often neglected nowadays — their human side. Whatever it is, the hobby fair arouses their emotions to the extent that they want to do, to create, to excel without being urged or forced.

You can haul coal to Newcastle, tomatoes to Cambridge, hats to Baltimore, and water to Niagara, but you can't make a boy ride a hobby. It is an attitude that comes from the emotions of the heart and will fail if he is a mere brain child. Various inducements have their values and encourage the boy to make a deeper study and a better collection, but the real enthusiast rides for his own satisfaction, and his greatest reward is not the ribbons, medals, and prizes but the joy of showing and telling visitors and friends about the strange and amusing bits of gossip and history that come from his hobby. A hobby is a personal thing and offers more freedom of choice and action than any other activity. Boys succumb to inertia because their full interests and abilities are not explored and developed. Some who have energy, unless guided, turn their thoughts and efforts to the temptations which are so

The Hobby Fair

increasingly prevalent. That ounce of prevention we have been hearing about all these years is worth more than a pound of cure, but we Americans, it seems, would rather spend more time on cures than on preventions. The hobby fair is primarily a pre-proposition designed to cultivate the character of the boy so that he will gain satisfaction and knowledge on which to build happiness and we hope a solid foundation for his life's work, whatever it may be.

And right away you ask, How are you going to get a boy to like to do a thing well enough to keep it up? The answer is, confidence. Boys are keen observers of human nature, and they can analyze their parents' and teacher's actions much quicker than they can a paragraph. Guidance must be individual, whole-hearted and illustrative.

In this machine age we forget that the old-fashioned woodpile was a powerful disciplinarian. It not only gave the boy directed action but taught him how to organize and plan, and it absorbed much of his leisure time. Yet in these lazy kilowatt days when woodpiles are few and far between, our boys must have some helpful avocational activity. This is where the hobby fair fits in so nicely.

If you want to start a hobby fair, the first thing to do is find several live boys with hobbies and invite them to attend a little surprise meeting. Offer the hobby-fair idea as a suggestion. They'll like it. Then organize the exposition committee, elect a general chairman and the subchairman, whose duties are to plan the following:

Exposition: Set date, place, rules, invite judges and make judging rules, keep records.

Publicity: Newspaper write-ups, announcements, handbill copy, invite special guests, signs, gates.

Prizes: Local organizations, merchants, school funds, get blue and red ribbons, make up prize donors and winners sheet.

Entries: Sign up entrants and entry, make entry tags and draw for places.

Decorations: Locate tables, choose, secure and hang decorations, arrange for photographer, and clean up.

The next step is to secure an old catalog. Make it into a guide-scrapbook by entering the committee responsibilities on separate pages pasted to the leaves. Analyze each item and write up the details in as few words as possible. Everything done should be entered.

An *odd-object contest* can be run in connection with the hobby fair — anything odd, old, or unusual can be entered. You'll be pleasantly surprised. Do not forget that at these fairs, a ballyhoo man will prove interesting and colorful.

The boys and girls get executive experience from the committee activities, artistic experience from display, and organizing experience from collecting. There is nothing just like a hobby fair for personality emergence. Some boys literally have been saved by the hobby fair.

There are about 25 important items to organize, all of which can be handled easily by the committees with a little help from the adviser. A hobby fair will make your town a better place in which to live and your school a brighter place in which to work and will, no doubt, grow into a community fair. You can hold it as an individual activity, as a part of some special program such as a P.T.A. meeting or on some special holiday. You can charge or make it free. Either way you will have a crowd, for everybody likes to see the human side of a boy.

And now, why should we stress this apparently simple procedure of hobby riding? Well, because, in the first place, it is not so simple but very, very vital and complex; second, to create better tastes of appreciation for things that are good as opposed to things that are detrimental to the well-being of our students, who, in a few years, will become adults and will have spare time at their disposal. They should now be taught that they are to confront many perplexities which will require the use of a high degree of clear judgment in the selection of wholesome activities best suited to their needs. It is hoped that through well-directed avocational endeavor they will become happy and substantial citizens.

Junior-High Printing Tests

Harold H. Kirk

Central High School, Cleveland, Ohio

The five completion-type tests for the junior-high-school student of printing may be found helpful by other printing teachers.

TESTING changes class supervision and instruction from mere guesswork to scientific accuracy. Until recently, teachers of printing and other industrial-arts subjects measured the results of a year's work in the shop almost by guesswork. Personal opinion, and likes and dislikes, were the chief factors used to determine the efficiency of the pupil. There was no yardstick to show the returns of instruction, or to indicate whether the things learned were anywhere near the things that had been taught.

The testing for the printshop was developed within the last few years. The pupils like the tests. Planned ahead for the whole term, they are a timesaver. They can be printed, several dozen at a time, and used without adding to the instructor's work, or detracting much from the time given to the regular class projects. These five completion-type tests, submitted from a group of fifteen, cover the introduction to elementary typography and are an excellent gauge of the first six weeks' work.

Each test is given three times. This enables the instructor to check the individual progress of each pupil and to know the backward pupil who needs personal help.

THE TYPE CASE
Test 1

1. Type in our shop is kept mostly in ..... job cases which are divided into .....: equal parts. This kind of case was designed by a man from the state of ..... and is a combination of two ..... cases.

2. It is necessary to make a drawing of the job case, because it aids in the ....of the characters.

3. Printers in Chicago and Montreal use the ..... kind of case as we use in Cleveland.

4. All capital letters are arranged alphabetically in the California job case, except ..... and .....

5. Spaces and quads are located in the case near the ..... and .....

6. The lower-case letter .. is used most often, and therefore has the ..... compartment or box.

7. The following ligatures are found in the California job case: ....., ..., ..., ...

8. Type is kept in a case in a type cabinet, or on a type .....

9. Speed in setting type is gained by knowing the ..... of the characters in the case.

10. A printer always refers to capital letters as ..... or ..... and to lower-case letters as ..... when abbreviated.

SPACES AND QUADS
Test 2

1. The California job case is divided into five parts:
a ....., b ....., c .....
d ....., e .....

2. Spaces and quads are pieces of type

..... that are not type high and so do not print.

3. The em quad is the ..... of any size of type, and is used mostly for paragraph .....

4. The en quad is ..... as big as an em quad and is used to ..... space between words when the line does not quite fill the measure.

5. The 3-em space (called the regular or thick space) is used as a space between ..... of the line. It is ..... of an em quad.

6. The 4-em and 5-em spaces are used to change the spacing between words either to ..... the spacing or to ..... the spacing.

7. There are 2-em and 3-em quads which are ..... times and ..... times as large as an em quad. They are used to ..... lines of type and to ..... lines at the end of paragraphs.

8. Spaces and quads are located in the case near the ..... and .....

9. In a 15-pica measure of 10-point type, there are ..... em quads and 2-em quads and ..... 3-em quads.

10. Spaces and quads are not part of a font of type, but are bought separately by the pound, and added to the cases. They are not type .....

THE COMPOSING STICK
Test 3

1. The name of the tool in which type is set is called the ....

2. The stick is made of ..... metal.

3. The ordinary composing stick is ..... inches long and is ..... inches wide.

4. The front edge or top of the modern adjustable stick is marked off in ..... and .....

5. The movable part of the stick is called the .....

6. The stick is held in the ..... hand with the thumb ..... to keep the type in place.

7. The type is placed in the stick with the nick turned .....

8. The stick should not be opened after the job has been started because to do so may ..... the type.

9. Next to type in delicacy is the composing stick. It should always be kept in ..... good condition and should never be ..... on the floor.

10. After a job has been distributed and the type has been stood up in the case, the composing stick should be .... to the place designed by the instructor.

JUSTIFYING AND CENTERING LINES OF TYPE
Test 4

1. A line of type is centered when there are ..... number of spaces and quads on each end of the type.

2. The first step in centering a line of type is to set the .....

3. The second step is to find ..... of spaces and quads that will be needed to fill out the balance of the measure.

4. A line is justified when it will .... in the stick without falling when the stick is tilted forward.

5. Tipping the line slightly forward to see if the line is tight is called a step in .....

6. An equal number of spaces and quads placed on each end of a line will .... the words in the measure.

7. Loosening the knee of a stick while setting, in order to put in a thick or thin space, will ..... the whole line.

8. In centering a line, the spaces must be placed next to the ..... so they will not fall down when the type is removed from the stick.

9. In taking a proof, be sure that the spaces and quads are not type high or they will .....

10. The spaces used in spacing are four sizes, namely: ....., ..., ..., ...; and the quads are: ....., ..., ..., ...

PARTS OF A PIECE OF TYPE
Test 5

1. Pieces of type are built very similar to the human body. Each part of the type has a name. Starting at the printing surface, there are the following parts:
a ....., b ....., c .....,
d ....., e ....., f .....,
g ....., h ....., i .....

2. The face is the ..... surface of the character, and is composed of the ....., ..., and .....

3. The shoulder prevents the letters from ..... when two lines are set solid.

4. The main part of the type letter that gives height to the letter is called the .....

5. The nicks are on the side of the type to aid in showing proper ..... of the letter in the stick, and to show wrong-font letters.

6. Type stands on its ....., and the distance from the feet to the printing surface is ..... of an inch.

7. Type metal is an alloy of ....., ..., and ....., and sometimes a little .....

8. Lead in the type alone would make it too soft to stand the squeeze in the press, so ..... and ..... were added to give hardness and toughness.

9. The size of type we use in setting up our lessons is .... point, and the name of the type is .....

10. Ink drying on the face and around the serif prevents a clear impression, so type is washed with a .... before distribution.

Common Woodworking Tools—VII

E. M. Wyatt

West Technical High School,
Cleveland, Ohio

The seventh installment of the history of woodworking tools.

THE PLANE

THE story of the plane is one of evolution more truly than can be said of most of our hand tools. Some tools, like the scriber, once invented, change little from age to age, but not so with the plane; it has evolved step by step from ancient times to this very generation. It is not one of our oldest tools, unless we consider the chisel and adz, from which it doubtless evolved, as being planes.

Probably the earliest written reference to this tool is in the Bible, Book of Isaias: "The carpenter hath stretched out his rule, he hath formed it with a plane," etc. But we cannot be sure of the translation of the word *plane*. It must have been some form of shaping tool, and, partly on this evidence, some writers have ascribed the invention of the plane to the Hebrews.

Perhaps the builders of the commerce-seeking ships of ancient Phoenecia were the first users of the plane. How could they have built the ships they did without some such tool? The Phoenecians made chisel-shaped implements of stone, but how they used them we do not know: perhaps in some crude plane like Figure 69, which is the artist's conception of the beginning of that tool. It is from crude beginnings like this that our tools have evolved, and we can only speculate as to just when and where many of them originated. What we know regarding the origin of the plane is that when we first find historic proof of its existence, it is such a thoroughly developed tool that we feel that it must have gone through a long period of evolution before that time.

We are convinced that the Egyptians had no knowledge of the plane. A great many of their old tools have been found, and not one of them is a plane; the pictures they carved show workmen shaping wood with chisels, saws, and adzes, but these same pictures show that they smoothed their work by rubbing it with pieces of sandstone.

We know the Romans had well-developed planes, for many of them have been preserved for us. They were really fine tools; some that are now in museums, if in their original condition, would compare favorably with many marketed today. The very refinement of them makes us doubt if the

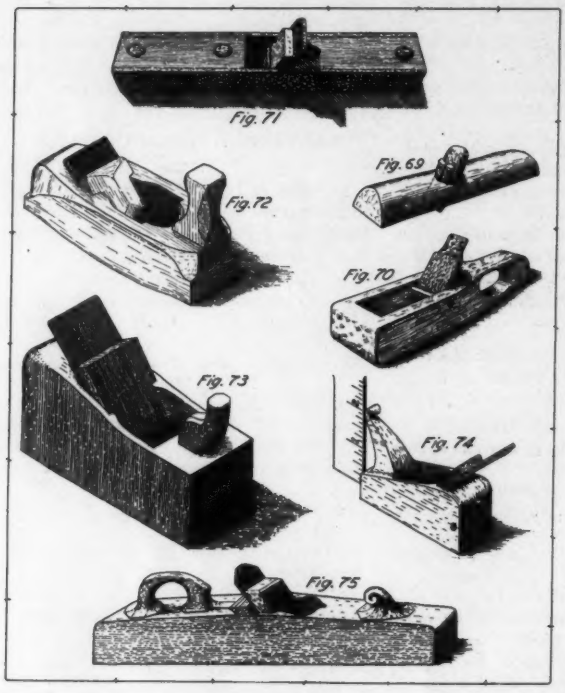


Fig. 69. The artist's conception of the first plane — a stone chisel wedged into a billet of wood. Fig. 70. A Roman plane dating from 50 B.C. Interesting because of its iron-bound construction and the use of the crossbar as a means of holding the wedge. Fig. 71. An ancient plane believed to date from the time of the Roman occupation of England. The drawing is a reconstruction from photographs of the badly rusted and decayed remains but which showed all parts except the wedge which the artist supplied. Fig. 72. Plane from the picture MELANCHOLIA drawn in 1514 by Albert Dürer. The side grooves for the wedge and the knob were not found in the Roman plane. Fig. 73. Dutch smoothing plane dating from 1596. Wedge and iron supplied by the artist. Fig. 74. This eighteenth-century French block plane is so small it could be concealed in the palm of the hand, so the horn is but an ornament. The hole is for a cord to be attached to protect it from being lost about the bench. Fig. 75. A plane redrawn from a French encyclopedia dated 1769. Notice the ornamental horn, cut-away wedge, and single iron bit. The tote is shaped more for carrying than pushing

Romans did not inherit the tool in a more primitive form from an older people. One studying the iron-shod, well-handled tool in Figure 70 can hardly believe such a plane was made nearly 2,000 years ago, or that such was the primary form of the tool. The Romans may have used wood bed planes, but, if so, none of them have been preserved. The one shown in Figure 71 is of a late time in Roman history but, like the one in Figure 70, has an iron sole and the same crossbar means of holding the bit and wedge that is generally used on block planes today.

There is a long span of centuries from the days of these Roman metal-shod planes to the time when we pick up the plane again. During the Renaissance Period, it becomes a wooden bed instrument with the wedge held in place by side grooves, and with a knob for the hand. We do not know just when these changes occurred, but two planes dating from the sixteenth century show them. Figure 72, representing the earlier of these, is from a picture, *Melancholia*, made in 1514 by Albert Dürer. It shows a well-made knobhorn (as it was called then) and the newer way of holding the wedge and iron. The plane in Figure 73 dates from 1596, and has a

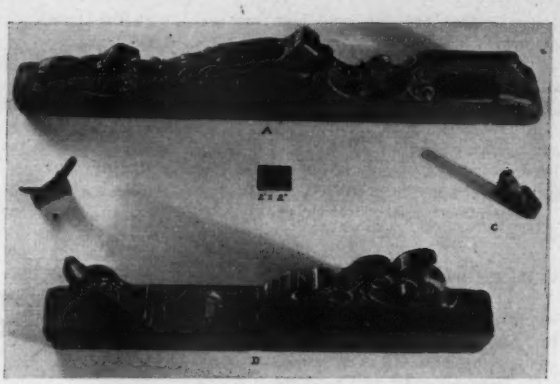


Fig. 76. Seventeenth- and eighteenth-century European planes now in the Cleveland Museum of Art. (A) Spanish plane, probably seventeenth century — ornamental carving, horizontal tote, heavy wedge, round throat, missing iron evidently single. (B and C) French block planes. Same as Figures 6 and 9. (D) Italian plane evidently of late eighteenth or early nineteenth century. The throat is recessed for the screw of a double plane iron and the tote turned upward for aid in pushing. The setting of the tote was doubtless to aid in keeping the tool parallel with the direction of the stroke

distinct horn as have several planes of later dates illustrated herein. The horn seems to have been as much an ornament as a hand-hold, as is shown in Figures 74 and 75. Not until the modern factory-made plane appeared, did the knob become primarily a place for the hand.

The rear hand-hold was used on the Roman plane, as illustrated in Figure 70, but does not appear on later planes until about the seventeenth century, when it seems to have been introduced more as a means of carrying the tool than as an aid in planing. This is evidenced by the fact that it was called a *tote*, and because of the awkward horizontal form in which it was made. Study the totes of the planes in Figure 75, and at A, Figure 76.

A marked improvement in the working quality of the plane was made about 1700. This was the introduction of the second

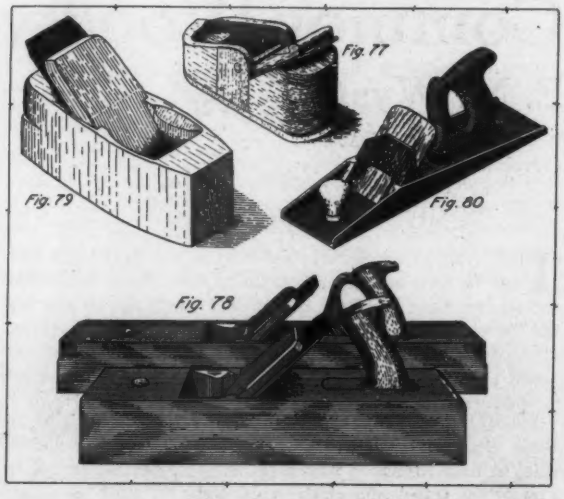


Fig. 77. French block plane of the eighteenth century. Interesting because of its brass sole and side plates and the iron crossbar for holding the wedge. Fig. 78. Factory type of jack and jointer planes made in the United States from 1828 to 1880. Fig. 79. Nineteenth century factory-made smoothing plane. Fig. 80. The first cast-iron plane, invented in 1827 by H. Knowles

cap, or curling iron that curled the shavings and made it possible to plane against the grain, or smoothly on wood of tangled grain. This second iron was not at first fastened to the cutter by a screw as we now find it on our double plane bit, but was held in place simply by the pressure of the wooden wedge. The bits are missing in the two large planes shown in Figure 76, but it is quite evident that the upper one dates back to the single-plane-iron age; the wooden wedge fits with too little space for more than a single iron. Further, the planed sides of the planes shown in Figure 76, show splintery surfaces that would hardly have been left by the maker if he had possessed a double-iron plane which would have planed it more smoothly. The introduction of the curling iron was the greatest improvement of the plane up to the improvements of the last century.

Up until the beginning of factory manufacture of tools in the early part of the nineteenth century, master workmen usually made their own tools. It resulted in considerable individuality, and frequently overornamentation of a workman's tools, for his tools were largely his certificate of craftsmanship. This custom, that a workman should make his own tools, largely accounts for the fact that the woodworker's tools were, wherever possible, made of wood. When the factory era began, the manufacturers accepted the plane as a wooden tool, and made only those adaptations that were required for quantity production. The planes in Figures 78 and 79 are products of the factory era. Planes like these were made in Pine Meadow, Connecticut, for fifty years following 1828, with almost no variation of pattern. Many who read this, have seen and used these old-type planes and know how they were operated. These may skip the next paragraph which is intended for those who are not familiar with these planes.

The iron was held in place by the wooden wedge that served in lieu of the lever cap on the modern tool. This wedge was tightened in tapered side grooves by driving with a hammer. The iron was adjusted for depth by being set light and driven to the desired depth by taps of a hammer. To lighten the cut, it was necessary to pull the wedge and cutter out and reset for depth all over again. The removal was accomplished by pulling on the wedge and striking the top of the cylinder of end-grain wood set in the front of larger planes (see Fig. 10) and the rear end of smoothing and block planes. This resetting was time-consuming work and was not done as often as a user of a modern plane adjusts his bit. Instead of so much adjusting, the old-time workman used several planes varying in depth of set. In preparation for the fine finishing strokes of a jointer or smoothing plane, he used a coarse-set foreplane. We now designate a foreplane by its length but it got its name because it was used *before* the finer-set planes.

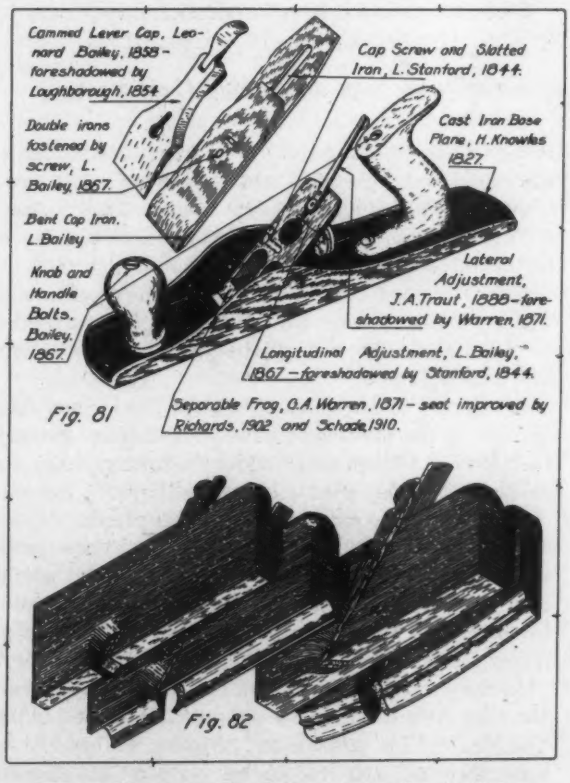

Cammed Lever Cap, Leonard Bailey, 1858 – foreshadowed by Laughborough, 1854
Cap Screw and Slotted Iron, L. Stanford, 1844.
Double irons fastened by screw, L. Bailey, 1867
Cast Iron Base Plane, H. Knowles 1827.
Bent Cap Iron. L. Bailey
Lateral Adjustment, J.A. Trout, 1888 – foreshadowed by Warren, 1871.
Knob and Handle Bolts. Bailey. 1867
Longitudinal Adjustment, L. Bailey, 1867 – foreshadowed by Stanford, 1844.
Fig. 81
Separable Frog, O.A. Warren, 1871 – seat improved by Richards, 1902 and Schade, 1910.
Fig. 82

Fig. 81. Major contributions to the modern or Bailey plane. Fig. 28. A group of special planes

The modern iron plane is quite a radical change from the 2000-year-old wooden one, but it is not a one-man invention. It evolved through the contributions of many men during a period of about 100 years. See Figure 81.

We can quite well consider that the modern plane had its beginning when H. Knowles, in 1827, patented a cast-iron bed plane. The ancient Romans had made planes with wrought-iron soles, but for a thousand years following, the plane had been a wooden tool made by woodworkers. Not until the factory era began did manufacturing conditions favor a plane of any other material than wood. Knowles' plane had the channel-shaped body and the turned knob of the modern plane. But the handle looked like the tote of the wooden plane and the cutter was held in place by a wooden wedge as it had been ever made up to that time. See Figure 80. Probably this plane was not very generally used; it was too revolutionary; but it opened the way for the modern iron plane.

In 1844, T. Stanford patented a screw adjustment by which the bit could be adjusted longitudinally, or up and down, without hammering. It was simply a wing screw that directly pushed or pulled on the bit, practically as the adjustment is still made on the modern Gage plane. It had to be improved later by T. W. Worrell, and still later by Leonard Bailey, who put the longitudinal adjustment in the handy location near the forefinger where we have it now.

To Leonard Bailey must be given credit for more features of the modern plane than all his contemporaries. He was not the first to conceive of doing away with the wedge for holding the bit, but he invented the lever cap that is so superior to it, that no plane maker since would think of going back to the ancient means of fastening. He standardized the practice of fastening the bit and curling iron together with a screw, if he did not actually invent the arrangement. He first fastened the knob and handle to the bed by bolts through them. He was the inventor of the bend in the lower end of the curling iron. This was a simple idea but an important improvement; it insured a pressure at the lower end of the bit that made possible, for the first time, the use of the thin, easily sharpened bit now used on all planes. He developed the adjustable frog that permits the operator to control the width of the shaving throat. These and many other inventions made by Bailey between 1858 and the end of the century, so modified and improved the modern plane that we frequently and quite properly call it the Bailey plane.

However, not all of the features of the Bailey plane are inventions of Leonard Bailey. The style or general arrangement, and the idea of a lateral adjustment are contributions of G. A. Warren. Warren's lateral adjustment, patented in 1871, was needlessly expensive, and so gave place to the simple lever now used, that was invented by J. A. Trant in 1871. Warren's greatest contribution to the modern plane was to give it its present graceful lines, pleasing balance, and convenient arrangement of parts. This improvement was never patented and perhaps never remunerative to its designer, but it was a very real contribution to the plane, and one for which he should be remembered.

The bedrock plane with its frog so made that the throat opening can be adjusted without removing the bit, was developed by the Stanley Rule and Level Plant in 1895. Its con-

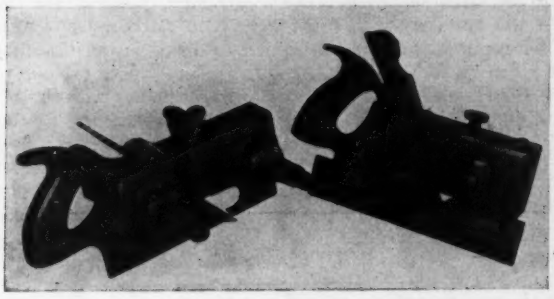


Fig. 83. Special planes

venient adjustment of the throat is an improvement appreciated by careful workmen who will make little adjustments to improve the working quality of their tool. However, it was a refinement evidently not generally appreciated, for, after 40 years of existence, it has not supplanted the older frog.

The Gage plane, now made by the Stanley Plant, was developed by the Gage Company as a wood-bottom plane about the time the bedrock came out. If it had originally had its present metal bed, it would doubtless have proved a more popular tool. Now, it is too closely in competition with the Bailey and bedrock for one to predict its influence on the plane of the future.

One should not drop the subject of planes without some attention to the many special planes that formerly occupied a large part of the space in every cabinetmaker's tool chest. There were special planes for making dadoes, rabbets, tongue and grooves, rounds, hollows, reeding, and complete moldings, and for many of these purposes there had to be a full assortment of sizes, so that there was no limit to the special planes a woodworker might accumulate. These special planes probably were not used in ancient times, though some writers credit the Romans with having rebate planes, but during the Renaissance, when ideals of beautiful architectural details developed, these special planes had to be used to produce the intricate panels, delicate moldings, and complicated work that builders put into their structures. Many of these special planes (see Figs. 82 and 83) are still in existence, although little used. The commercial production of standard moldings and the use of machinery for cabinetmaking has practically done away with the need for these special planes. Now, the universal molding plane, with its score or more of assorted cutters, fills the little need left for any special hand planes.

The plane has evolved into the most intricate of the woodworking tools. In a sense, it has become more than a tool, for most woodworking machines are but superplanes and these machines have largely usurped the work of the simple tool. Probably there will always be some place for the hand plane, and it will continue to change by the gradual elimination of inferior details and the addition of improved ones. It is doubtful, however, if the changes of another century will be at all equal to the many changes which have been made since the appearance of the first cast-iron plane a little over 100 years ago. If it does, it will be by the elimination or alteration of the 2000-year-old basic idea of a chisel held in a depth-controlling gauge.

The Machinery of Daily Life

Laurence Parker

State Teachers College,
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The author in his own inimitable way points out why industrials-arts teachers must continually keep on developing their work.

WHEN your parents and mine were busy saving up their money to take them to the World's Fair in Chicago in 1893, related science and technical information did not play as big a part in the trades and in daily life as they do now. At least as we look backward from the present day they did not seem to.

As we think of all the processes of manufacture needed to make the "light four," "the six" and the "straight eight," the old buggy was pretty simple in construction and theory. The working of Swedish iron and second-growth hickory must have caused less worry than handling present-day alloy steels. A certain amount of "dish" to front wheels seems simple compared with the camber of front wheels on our cars today. There had to be a right and left thread on the proper end of each axle to keep the wheel from working the nut loose and letting the wheel come off, but it's hard to think of this as technical information. The brake was quite simple as compared with four-wheel hydraulic brakes.

When it came to running and maintaining the *family bus* of that day there was much less technical information needed. It was arranged for right-hand drive and the *starter* rested in a socket on the very low *windshield*. When in bad order, the starter, or whip as it was called, was replaced at a harness shop for 75 cents. It was seldom that anyone failed to understand its use.

There were no cylinders to bore or ream, pistons to fit, or valves to grind on the motor of that day. A veterinarian took care of cases of engine trouble and when a motor showed too much wear, it was traded for a better-running one. At that, motors had a longer life then than now.

It was easy to learn that corn was a good winter fuel to burn in the motor and oats a satisfactory summer fuel. Drivers seemed to get about the same mileage per bale, whether they used wild or tame hay. All this discussion on fuels sounds simple in this present day of "navy," "benzol," "straight," "pressure," "new process," and "ethyl" gasoline. Any filling station would do in those days if the water trough seemed clean. Compare this with the conflicting claims of makers of motor oil as displayed in the *Saturday Evening Post*.

In the old days most men let the barber worry about the edge he must keep on his razor and "the pulling qualities" of his scissors and clippers. Father had to remember to go to the barber shop on the regular days, which is hardly technical information.

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Today the head of the house has his *stable* of safety razors and often a mechanical device to keep the blades sharp. Often he has clippers and scissors so that he can lengthen the interval between the visits of his wife and children to the barber shop. Skill and technical information that was not needed before will help him now.

Mother in the old days was not a machine operator. Give her a good corn broom, a mop, a stiff scrubbing brush, two or three good washtubs, a boiler, and a washboard and she was prepared to subdue dirt, her ancient enemy. About the only machinery she had was the egg beater, the clothes wringer, and the carpet sweeper. There wasn't much related science and technical information needed for their use.

Today the modern home is a good-sized machine-operating establishment, with its washing machine, electric refrigerator, electric sweeper, electric iron, gas-and-electric mangle, electric dishwasher, and electric dough mixers. Sometimes there is also a wringer for the mop.

In the old days they did have the sewing machine. Much of its operation, and its failure to operate at times, proved a mystery to all, including the man who had sold it. We have practically the same machine today, but with an electric motor and a sewing light in addition to maintain.

Cooking, back in horse-and-buggy days, was conducted on a range which either would or wouldn't burn according to whether the housewife showed herself a good fire maker or a poor one. Even at that it was less complicated than the gas, gasoline, and oil stoves of today with their burner adjustments and fuel regulators.

Father is also a machine operator around home. He used to have to fill the water tank on the cookstove for family baths. Now he must maintain the automatic hot-water heater. He may even have a water softener now to recharge and purify. He used to lift a scuttle of hard coal as high as his head in order to fill the base burner. His job it was, to shake the grate and carry out the ashes. Now he wrestles with a furnace which may burn oil or gas under the direction of a thermostat which he must maintain. He may have a blower motor, oil pump and spray nozzle to see to. Considerable more trade skill and trade science to all this than there was in sifting ashes out behind the barn on a frosty morning.

Cooking in the old days was a fairly simple job. You cooked fresh vegetables in summer and canned ones in winter. Vitamins if served at all were served without anyone knowing about them. Today there is a great range of foods the year round, some of which are good for use and some which are not so good.

The bookkeeping department used to be the most peaceful part of the factory. Here men sat on tall stools at high desks and methodically wrote in big books as if practicing an ancient rite or ceremony.

Today the auditing department clatters almost as loudly as some of the manufacturing departments. Bookkeepers today are machine operators, using ledger machines, billing machines, adding machines, calculators, and dictating machines. Usually they are spry young folks who can ruffle the pages of their ledgers, slip a page out, into the machine, post items and return it to the ledger in a twinkling. There is considerable technical information needed in modern cost accounting and in maintaining the machines used to accomplish it.

When father hired out at his trade in the old days, he took most of the tools that he needed for work with him in his box and when he damaged a tool it was usually one of his own. Now he may operate a machine tool which costs the employer more than the house in which the average worker lives, and the tools in the crib take the place of the ones father used to own. There is much trade skill, technical information, and trade science tied up in their use today. The endless variety of materials which are used by father in the factory furnish many problems of related science and technical information.

On the farm, hand tools and comparatively simple farm machinery in the old days did not call for the use of very much technical information. Today the tractor and truck are only a part of the farmer's problem. Much technical information on crops and livestock is constantly being discovered and should be made use of by him. He has his radio, a lighting plant, a water system, and a milking machine to maintain as well.

These are all examples to show that in the old days there was, or seemed to be, less technical information and related science needed to get along well in life. What there was, was easily acquired from parents and well-informed neighbors. That was the natural way to learn how to build a fire in the kitchen range, what little was known about diet, seed selection, and the care of *the family bus* and other machinery.

Today father, mother, and well-informed neighbors cannot keep up at the job of learning the related science and technical information of daily life and so the teaching of such things, together with many of the skills, has passed into the hands of those who make it their business to know how to do things, why they do them as they do, and know how to teach others what they know. This is an age of specialization and this big work of teaching oncoming generations to operate the machinery of daily life becomes a trade.

Lewis Gustafson, once said: "Whenever any knowledge or experience in the community that is necessary or desirable for the young of that community to receive or undergo, can no longer be imparted to the young through normal and informal participation in its affairs, then it is the business of the community to provide systematic and definite means for its impartation in schools or through some other agency; and that usually means the schools."

As a result, we, the industrial-arts teachers, are confronted with the job of continually developing our work so that we are able to give our students a type of practical education that will make the next generation efficient operators of the machinery of daily life.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

The Matter of Requisitions

Again and again some harassed correspondent will send an S O S asking for a layout, lists of tools needed, and the cost of equipping, we will say, a general shop. This leads one to wonder whether such a writer has made any attempt to think through the problem with which he is confronted.

Take for instance, the planning of the general shop referred to in the foregoing. The term itself means many different things to different people. What mental picture did the correspondent have when he wrote about his general shop? How many activities and what kind of activities does he intend to include in his program? How many students are to be accommodated at one time? How many students will make use of the shop during the week? What are the ages of these students? Are the projects to be attempted small, or will they require much storage and assembly space in the school shop? Will a single activity occupy all students at one time or will a number of activities be carried on during each shop period? All these and more questions must be fully answered or at least thought about before anyone can begin to determine what will be needed. As a matter of fact, making out requisitions without having these data on hand is like shooting in the dark.

The teacher whose shop has been equipped and in operation for possibly years, will not have to go through quite so much mental exertion as the man who is planning a new shop. But even he must have a clear mental picture of what he intends to do with his classes — probably much augmented in numbers as most of them have been — during the next school year. He, too, must have a definite program laid out if he wants to be sure that his requisitions are based on actual needs and requirements.

It may be helpful for the teacher confronted with the duty of making out requisitions to read some articles on this subject that have appeared from time to time in this magazine. Among these are: "Specifying Equipment and Supplies for School Shops," by Earl L. Bedell, page 163, May, 1930; "Equipping and Maintaining and Industrial-Arts Department in a Large City School System," by A. G. Bauersfeld, page 157, May, 1931; "Industrial-Arts Departmental Supplies, Maintenance, and Equipment, Planning and Accounting," by Roy Van Duzee, page 143, May, 1932; and "The Annual Requisition," by Paul C. Hoopes, page 181, May, 1933.

He also may find much assistance in the tables enumerating the materials and equipment required for school shops in which are taught woodworking, printing, metal working, automotives, drafting, and electricity that have appeared in the February, 1935, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

Everyone will concede that the writing of requisitions is not easy, but much of the feeling of uncertainty which frequently accompanies this annual task may be avoided if the work is based on needs discovered by a careful study of the factors which make the requisitions necessary.

The Last Week of School

In preparing for the closing of the school shop, it is not too early right now to lay out a well-planned schedule which may be followed much as the tourist follows his road map. There is so much to be done by the teacher toward and at the end of the school year that it is well to follow a definite plan so that nothing of importance may be overlooked.

The following list, probably far from complete, may be found helpful.

1. If possible, have all incomplete work finished by the students before the end of the school year.
2. Make arrangements for keeping all students profitably occupied to the very end of the school year.
3. Plan to have each class contribute something in the way of repairing, replacing, or producing something new for the shop. Under this heading may be placed such things as painting walls; glazing windows; laying floors; building bulletin boards, cabinets, shelves, and racks; sandpapering drawing boards, benches, etc.; refinishing the teacher's desk and chair; preparing illustrative material; and other similar jobs.
4. Assist those who are leaving your shop to organize the information which they have gained while taking your course, so that it will be of maximum value to them in their choice of a vocation.
5. Plan to examine your students in an objective manner to determine whether they have profited, as much as they ought, from your instruction.
6. Assign and record the semester grades.
7. Help those of your class who may be about to leave school to plan their activities for the immediate future. This is especially necessary under present conditions.
8. Impress upon the graduating students that the school is still interested in them, and that each individual teacher will be glad to serve as adviser and councilor whenever opportunity offers.
9. Make a thorough inventory of everything in the department.
10. Clean out all cupboards and lockers.
11. Sort out and repile all supplies and material, cleaning and regrouping it as experience dictates.
12. Examine the room — floors, walls, ceilings, windows — and electric light and power circuits and switches, for necessary repairs or alterations.
13. Examine all power machinery for eventual repairs or replacement.
14. Examine all hand tools, and arrange to have dull tools reconditioned, and broken tools repaired, or replaced.

15. Protect all metal tools against rust and corrosion.

16. Determine what will be required in the way of new materials, supplies, and equipment and make out the necessary requisitions.

17. Clean off the bulletin board, and provide new material for it for the coming year.

18. Carefully check over your reference library and stock of shop magazines. Some of the books may need repairs, others must be replaced. There are new books that you may want to add.

19. Check and revise the outline of instruction and the instruction material used during the year.

20. Revise, bring up to date, improve and, add to your present supply of illustrative material.

21. Assemble and make arrangement for a shopwork exhibition, hobby fair, or prepare to present a playlet with your students at some school assembly session in order to acquaint faculty and students with the things that your department is offering and accomplishing.

22. Prepare your own vacation plans. Professional improvement ought to be given at least some consideration in this planning.

23. Get permission to secure your shop in such a manner that unauthorized persons cannot enter it during the vacation period.

24. Check back carefully whether you have made all the changes, repairs, or additions, to your shop, supplies, equipment, instructional material, reference library, that you may have planned during the year.

25. See that all your records, requisitions, and keys are in the hands of the proper officials before leaving for your vacation.

A Commendable Study

Another school year will be finished in the near future and a new group of students will graduate or discontinue their schooling. What will these young people do?

A conference of superintendents, principals, and industrial-arts teachers will be held shortly at New Britain, Conn., at which it is to be determined just what type of program will be best fitted for taking care of this over-age group. Prominent men in the field of industrial arts and vocational education have been asked to address and help these Connecticut educators who are so earnestly searching for a solution of the youth problem which confronts us today.

These schoolmen are earnestly striving to determine what industrial arts and vocational education can do, not only in preparing the young for a life of usefulness, but also to fit them for properly using the enforced idleness which our present economic society unfortunately has forced upon those who are now leaving school. It is unfortunate that this is happening at a time in the lives of these young people when they are most yearning for activity. A study of how best to take care of them is, therefore, a most serious matter. It is now when they need the most careful guidance lest, in their determination to satisfy their urge for action, they acquire bad rather than good habits for the future.

It augurs well for the success of the program that in all probability will be evolved, that it is the result of the combined efforts of superintendents, principals, and industrial-arts teachers. Had these three groups more often worked together in the past, industrial-arts work would have struck less shoals and would have progressed much more rapidly.

An Antidote Against Radicalism

In an answer which Mr. Babson, nationally known prognosticator of financial trends and events, gave to a client who asked him for the best hedges against inflation and unsound radicalism, many points are outlined that good teachers have long accepted as the objectives for present-day education.

In Mr. Babson's estimation, the development of good health habits, character training, and the acquiring of a discriminating attitude in choosing between right and wrong leisure pursuits are most desirable. He also calls attention to the importance of learning how to budget one's time thriftily, and he emphasizes that even the man of advancing years ought to be a performer rather than a mere onlooker at games and sports.

The teacher of industrial arts and vocational education and all those who are interested in this type of education and in the wealth of good it can contribute to the broad field of education and to life in general, will derive considerable satisfaction from the fact that Mr. Babson mentions a number of the things which they have already embodied in the work with their students.

In his answer to this client, attention is called to the large number of clubs that may be formed, which all have for their aim the satisfaction of the collecting instinct. The possession of a near-by productive farm also is advocated by Mr. Babson. Evidently he does not mean that this farm should be entirely cultivated by hired help. He likewise lists antique furniture and precious stones among his "hedges" against inflation and unsound radicalism. Again these last two items may be looked upon both from the viewpoint of the collector and from that of the handcraft enthusiast.

Mr. Babson's advice is usually sound and it must surely be conceded that the answer to the client referred to in the foregoing contains an immense amount of common sense and sage advice.

As already said, many of his suggestions have been embodied in the objectives set up by teachers of industrial arts and vocational education for their work, but the special emphasis placed upon these objectives as "Hedges against inflation and unsound radicalism" by Mr. Babson may well receive consideration and more specific attention by the shop teachers in molding the lives and characters of the young people now in attendance in the schools of our country.

Unglazed Pottery

R. H. Jenkins

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The author describes the operations of turning, firing, and decorating in a concise and interesting manner.

SMOOTH as a piece of pottery is, when it comes from the wheel for the first time, it is not yet finished. As soon as the vase is "thrown," it is set aside to stiffen to a leather-hard state, after which it is returned to the wheel, turned perfectly true, and a foot formed upon its base.

If the throwing was well done, the piece will need little turning except on the bottom, but in any case the bottom is an excellent place upon which to begin. Take a piece of pottery which has been hardened just enough to cut nicely (leather-hard) and turn it upside down upon the smooth head of the wheel. Grasp the piece gently with the palms of the hands on opposite sides, and endeavor to shove the work to the exact center of the wheel while the wheel is slowly turning. See Figure 1. At first this will be hard, but with practice should become comparatively easy. With a pencil and turning stick test the work still further to be sure the centering is perfect. This operation is shown in Figure 2. Use small wedges of clay to fasten the piece to the wheel head, as shown in Figure 3, and hold the dish firmly down with one hand while placing these wedges in position with the other.

Turning

In turning, hold the turning stick, shown at A in Figure 4, under the left arm, and grasp it with the left hand while the right hand operates the tool. (See also Fig. 5.) Hold the tool firmly against the stick, and move the stick to change the position of the tool. Either the loop (B, Fig. 4) or the round pointed tool (C, Fig. 4) should be used in taking off the roughing cut, and after the heavy material is removed, the skew (D, Fig. 4), or the square-edged tool (E, Fig. 4) should come into play. When all of the turning is finished, the piece should be thoroughly sponged and set aside to dry. When perfectly dry the piece must be lightly sandpapered and it is then ready for firing.

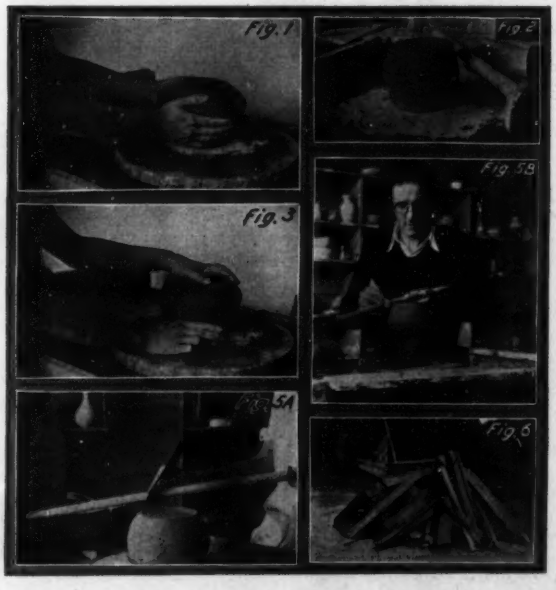

Fig. 1. Centering a piece to finish the turning. Grasp the piece, and let it slide gently through the hands, until it has been forced into the exact center. Fig. 2. Testing with a pencil. To be sure a piece is centered, a trial test should be made with a pencil. The work is shoved away from the side marked by the pencil. Fig. 3. Fastening the piece to the wheel. When perfectly centered, the work is held with one hand while with the other, wedges of clay are pressed into position. Figs. 5A and 5B. Turning. These illustrations show the method of holding the tool while the process of turning is going on. Note how the tool is held firmly against the stick. Fig. 6. Ready for the firing

Firing

The process of firing pottery may be very simple or complicated, depending upon the pocketbook and the tastes of the individual. Unless glazing is undertaken there is no need of making a difficult problem of it, and with our many lovely modern colors some very pleasing work can be done without glazing. The problem in firing is to have a slow, steady increase of heat, and an equally steady process in cooling. If a piece of pottery is placed directly in a hot flame it will break, but if protected by a good covering it will go through safely.

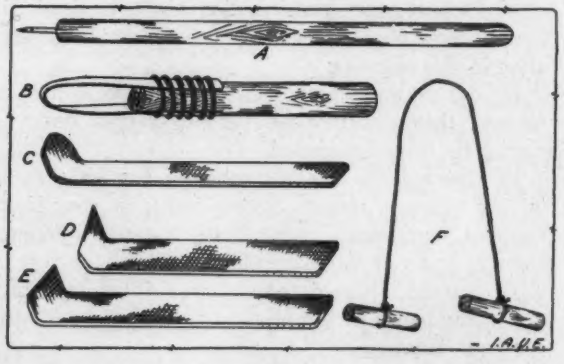

Fig. 4

Place the dry, finished pieces in any strong container that will withstand the weight of the fuel, and cover them over with dry sand or dirt. Care should be taken to see that none of the pieces touch the outside wall of the container, but rather be well covered with the sand. A good fire may then be built around this improvised kiln, as shown in Figure 6. This should be kept going for five or six hours, finishing off with a good hot blaze. The very sand which protects the pottery from breaking also keeps it from firing as hard as it would without the sand, so that more heat is needed than otherwise would be to get the same degree of hardness.

The cooling should go on for a longer period than the firing, and the unpacking should not take place until all is cold.

Decorating

After the firing the surfaces may be decorated in various ways. Primitive man used some very simple earthy colorants rubbed into the surface of the piece. These were used just as they were found in the open field. We have been saved this work of preparation as practically any paintshop can furnish us with any color we desire. The designs may be applied with the prepared oil colors, or the pigments mixed to suit the taste of the decorator. Where a paint is applied it will be well to use a good filler before applying the finished coat. A dull coat may be improved by polishing with wax, and to prevent leaking an application of very hot paraffin is helpful. Odd effects may be produced by dropping different-colored oil paints on the surface of water, and then dipping the piece of pottery into this mixture.

Some interesting results also may be obtained by applying

white liquid clay with a small brush on a dark firing background. This liquid clay, or slip as it is called, is applied to the dry piece of pottery before it is fired.

An interesting marbled effect may be produced by partially mixing a white firing clay with a red firing clay before throwing the piece upon the wheel. In fact, the whole subject is very interesting and well worth trying.

For further readings upon the topic the writer would suggest the following references:

Art of Pottery, by Gall and Van Etta, The Bruce Publishing Co.

The Potter's Craft, by Binns, D. Van Nostrand Co.

Pottery, by Cox, The Macmillan Co.

Pottery, by Lunn, Chapman and Hall, London.

Casting in the School Shop—III

N. A. McMillan

Elmira, New York

The third of a series of lessons on molding.

Project No. 3

Project: Molding an irregular pattern that requires coping-down — base of the colonial candlestick described on page 286 of the September, 1934, issue of this magazine.

Suggestive projects: lamp bases, plaque, or any solid pattern with uneven surfaces.

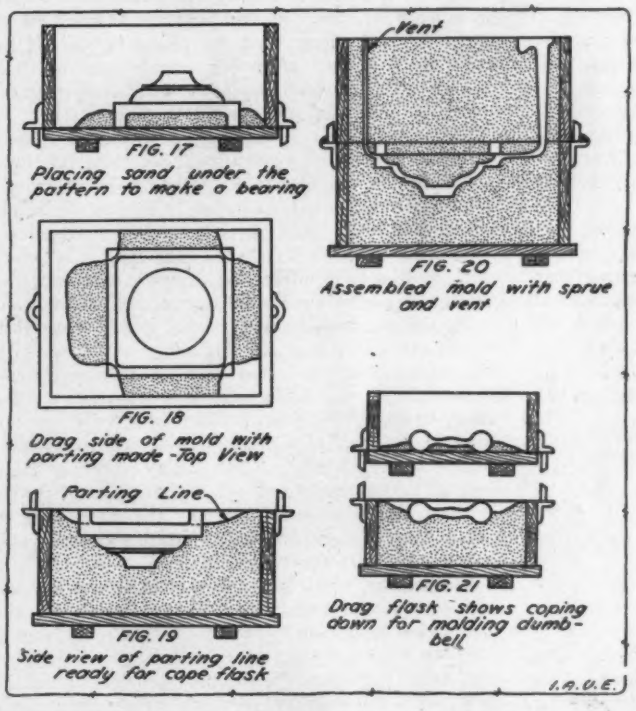
FIG. 17
Placing sand under the pattern to make a bearing
Vent
FIG. 20
Assembled mold with sprue and vent
FIG. 18
Drag side of mold with parting made -Top View
Parting Line
FIG. 19
Side view of parting line ready for cope flask
FIG. 21
Drag flask shows coping down for molding dumb-bell
I.A.V.E.

Tools and Materials: Same as in Project No. 2, which appeared in the September, 1934, issue of this magazine.

References: Foundry Practice, Palmer, pp. 15, 16, 17; *Foundry Work*, Stimpson-Gray, pp. 40, 65, 66.

Procedure: Projects Nos. 1 and 2 are the simplest to mold because they have flat backs that established the parting line between the cope and drag. Most castings are too irregular in shape to be molded in this manner. The new process to be learned is called coping-down, as in making the base for Project No. 2.

1. Place the pattern on the mold board, tucking sand under the pattern to make a bearing. This is necessary because irregular patterns might be sprung out of shape by the ramming if they were not given this bearing. The bearing also takes care of the back draft as shown in Figure 17. The sand under the pattern is removed when coping-down.

For a casting that requires more than one mold, a green sand parting is made in a *set-up*. A follow board is often made of plaster of paris which makes the parting line. For production, a *match plate* is used for making the parting line.

2. Lay the drag flask on the mold board and proceed as before.

3. Lay on the bottom board and rub to a bearing and roll the drag over.

4. Coping-down or making the parting, must be done carefully or the sand will break, and a poor casting will be the result. Dig around the parting line with a spoon or in this case as illustrated in Figures 18 and 19. Do not remove any sand below this point or back draft will be the result, causing the sand to break when the cope is lifted. Make a gradual slope for the parting, as a sharp parting will break in the cope.

5. Set the sprue pin in position. A small casting of this type with uniform thickness of metal does not require a riser, if properly vented. Shake parting on this joint.

6. Locate the cope flask in position and riddle the sand over the pattern and fill up the flask.

7. Remove the sprue pin and lift off the cope, being careful to set the cope flask on edge.

8. Dampen the edges of the mold and remove the pattern with a draw screw. Sometimes a pattern can be lifted with the fingers, depending upon the shape.

9. Cut the gate as illustrated in Figure 20.

10. Clean out the loose sand with the bellows and face the mold with graphite.

11. Replace the cope in position.

12. The mold is now ready for pouring.

Question Sheet

Molding and Irregular Pattern

Directions: This is a true-false test. Make a circle around the capital T if you think the statement is true, or make a circle around the capital F if you think the statement is false.

T F 1. By placing sand under an irregular pattern, it prevents the pattern from breaking.

T F 2. Sand placed under an irregular pattern also prevents back draft.

T F 3. After the flask is rolled over, the sand under the pattern is cleaned away and a parting is established.

T F 4. Three types of permanent partings used in irregular molding.

T F A. Dry-sand parting.

T F B. Green-sand parting.

T F C. Plaster-paris parting.

T F 5. A dry-sand parting has a lasting hard surface.

T F 6. A plaster-paris parting will not last as long as a dry-sand parting.

T F 7. A green-sand parting is more permanent than the other partings mentioned above.

T F 8. If the coping-down process is not done accurately, the sand breaks, because of back draft.

T F 9. A vent rod is sufficient to allow the gases to escape.

T F 10. The best surface of this pattern is placed in the drag because the opposite side should be free from gas holes when finished.

Instructor's Remarks:

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Small Electrical Transformers

T. C. Lloyd

Associate Professor of Electrical Engineering, Antioch College, Yellow Springs, Ohio

This article on the design and construction of small transformers will be found very helpful by teachers and students in the electrical shops of junior and senior high schools.

THE alternating-current transformer is one of the simplest and most useful of the various types of electrical machines. Its chief function is to step up or step down the voltage of an alternating-current supply. Through the development of the transformer, alternating current has become a practical means of transmitting energy over long distances in a comparatively economical manner.

The transformer will operate only on alternating current; there is no counterpart for it in direct-current systems, and consequently direct current must ordinarily be transmitted and utilized at the same voltage at which it is generated. Because power can be transmitted economically only by high-voltage transmission lines, the use of low-voltage direct-current power lines would have resulted in widely different industrial organization, with industries cluttered closely around central power plants.

Although the transformer has been of great importance in the distribution of electrical energy, it has found an immense variety of uses in other fields of electrical engineering. Any alternating-current device requiring a change in voltage, or a different voltage from that of the supply, can be economically served by means of the transformer. Since experimenters often wish to operate such devices, this article will attempt to show how a transformer may be scientifically designed and built without elaborate shop facilities.

The design procedure shown here is based upon the same principles used by the electrical manufacturing companies, and will result in designs with satisfactory operating characteristics. By following the suggestions of this article, small transformers (50 to 1,000 watts), can be built which will operate from a 110-volt, alternating-current, 60-cycle line, and which will supply proper voltage (from 2 to 70 volts, according to the design) for many devices. Some of them are:

Electric bells and buzzers.
Signal and alarm systems.
Toy trains and motors.
Low-voltage furnaces and heating pots.
Devices for thawing out frozen water pipes.
Charger for storage batteries (when used in conjunction with the proper rectifying apparatus).
Experimental low-voltage circuits.

Theory of the Transformer

Faraday, in 1831, placed two coils of wire on an iron core, and passed an electric current through one of them. At the instant of closing the circuit and at the instant of opening it, he noted a momentary flow of current in the second coil. Current through the first coil caused magnetic lines of force, or *flux*, to thread the iron core. This flux surrounded the turns of the second coil, but it was only when a change of flux occurred (i.e., when the current in the first coil changed) that a current flowed in the closed second winding. Faraday, having no conception of the use of atlernating current, did not pursue his experiment further, and it was not until fifty years later that practical use was made of his observation. No attempt will be made here to mention the contributions of various experimenters, but Gaulard and Gibbs patented (in 1882) what proved to be the forerunner of the modern electrical transformer. Most of the improvements which have been made upon their transformer came about during the next twenty years.

A transformer consists of an iron core on which is wound a coil of wire called the *primary*, to which the alternating-current supply is connected. Another winding on the core, called the *secondary* winding, has its output connected to the load to be supplied. Since we are causing an alternating current to flow in the primary, we are threading the core with an alternating magnetic flux. This flux cuts the turns of the secondary winding, inducing an alternating voltage in them. The voltage of the secondary depends entirely upon the ratio of turns in the primary and secondary windings. Thus, if the transformer is to step down the voltage from 110 to 55, it is necessary that the secondary have half as many turns as the primary. It is vitally important to economical operation that the number of turns on the primary, however, should be correct for the voltage used, the power rating, and the size of the core. Neglect of proper consideration of these last relations is responsible for the unsatisfactory operation of most transformers of amateur construction.

When the primary winding of a transformer is connected to the supply, it automatically draws from the lines just enough current to magnetize its own core. This current, called the magnetizing current, must flow so long as the transformer is connected to its supply lines, regardless of whether or not power is being obtained from the secondary. It is this current which produces the alternating magnetic flux, which in turn cuts the secondary conductors and induces in them an alternating voltage. But the iron core is itself an electrical conductor, and so the magnetic flux induces a voltage in it also. This voltage could cause large currents (called *eddy currents*) to circulate in a solid iron core, and thus waste considerable energy in heat. To eliminate this loss, transformer cores are usually built up of thin sheets of steel called *laminations*, insulated more or less from each other to prevent the voltage built up in one sheet from causing large currents to circulate in the entire core section. Usually the slight scale rust, or grease which accumulates on the laminations provides sufficient insulation to accomplish this.

Another loss, which is also dissipated as heat, occurs in the iron core of the transformer. This is called the *hysteresis* loss, and is explained by the assumption that an alternating magnetic flux apparently causes a molecular movement in the iron which produces corresponding molecular friction and heat. This hysteresis loss depends largely upon the quality of the sheet material used in construction.

Since both the eddy-current and hysteresis losses occur in the core, heating takes place in the core regardless of whether the transformer is supplying a load or is merely connected to the lines with disconnected secondary.

Two other losses are also present. When a load is connected to the secondary winding of a transformer, a load current flows through the winding. This current heats the copper wire, resulting in a loss of energy called *copper loss*. The loss varies directly as the square of the current, and hence can reach large proportions with slight increase in load. Now the load on the secondary has made necessary an increased current in the primary, and we get another copper loss in the primary winding. If the currents are excessive, the resulting heat will quickly char the insulation around the wire, reducing its mechanical strength and its insulating

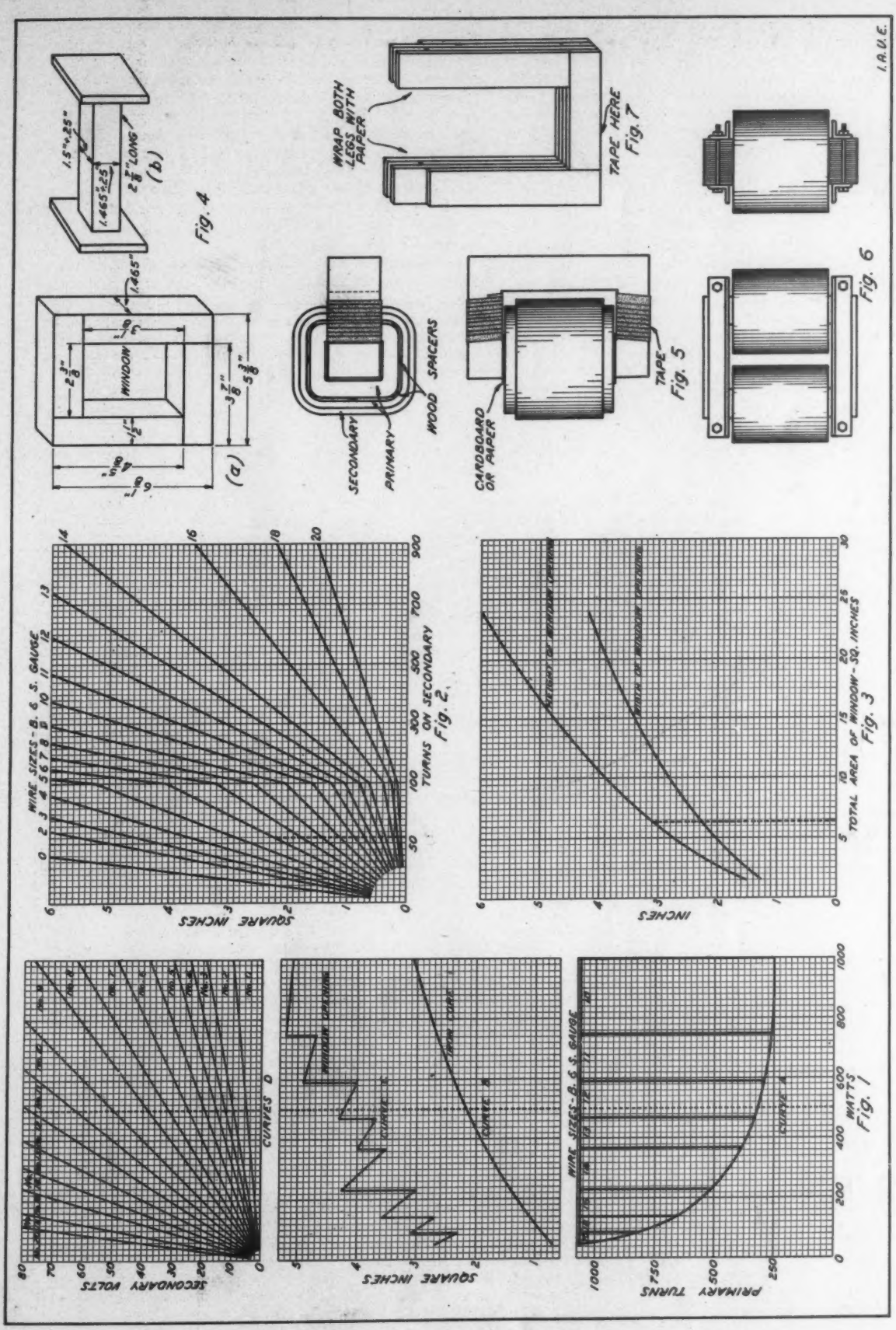

Fig. 1. Curves for determining wire sizes of primary and secondary coils, turns on primary, and the areas of the iron core and the window opening. Fig. 2. Curve for determining turns on secondary coils. Fig. 3. Curve for determining width and height of window opening. Fig. 4. (a) Completed core for the sample design; (b) Wood winding spool. Fig. 5. Entire primary and secondary on one leg. Fig. 6. Half primary and half secondary on each leg. Fig. 7. Method of stacking laminations

qualities. The wire sizes specified in the design procedure which follows are so chosen that the winding temperatures will be at a safe value, provided the transformer is operated at the voltage and current for which it was designed.

The sum of these losses represents, in a well-designed transformer, only a few per cent of the power transformed. Hence, high efficiency of operation is usually attained by the use of transformers. It is not uncommon for a large-size transformer to be as high as 99 per cent efficient, even when thousands of kilowatts are passing through it.

Sample Design

The curves given here pertain to that class of transformer known as the core type, in which the iron forms a core in the center of the windings. It is necessary that the cross-section area of this core and the area of the window opening (illustrated in Fig. 4) be determined with fair accuracy. The primary winding must have the correct number of turns in order to keep down the iron losses and the no-load current. The correct wire size is necessary to prevent overheating of the winding. As for the secondary or output winding, it is necessary again to determine the correct number of turns in order to obtain the desired voltage, and to use a large enough wire size to prevent overheating of the coils and consequent damage to insulation. All of these dimensions and data can be obtained from the set of curves, shown in Figures 1 and 2, after the designer has decided upon the rating of the transformer which he wishes to build.

As an aid in understanding the procedure, a sample design will be carried through:

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1. *The transformer must be connected to a source of from 110 to 120 volts, alternating current, at 60 cycles.* The watts output and the voltage output are selected by the designer. Assume that a transformer is desired for operating a small heating coil requiring 25 amperes and 20 volts. The output is then

20 volts × 25 amperes = 500 watts.

2. The base line in Figure 1 is laid off into watt ratings. Running vertically on the 500-watt line, we read Curve A, and note that 315 turns are required on the primary winding.

3. Since this falls in the area for No. 12 wire, the primary winding is then fixed in wire size and number of turns.

4. Continuing vertically on the 500-watt line, we read Curve B, and note that the iron core should be 2.2 sq. in. in cross-section area.

5. Curve C shows that 315 turns of No. 12 wire, with allowance providing for insulation, will require window space of 4.2 sq. in.

6. The set of curves indicated as D show the wire size required on the secondary winding for the desired voltage. The output voltage of this transformer is to be 20. The intersection of the 20-volt line and the vertical 500-watt line falls within the sector for No. 6 wire. This is the secondary wire size.

7. A calculation must be made here in order to determine the number of secondary turns required. This can be found by multiplying the primary turns by the ratio of secondary and primary voltages. That is:

$$\text{(Primary turns from A)} \times \frac{\text{Secondary volts}}{\text{Primary volts}} = \text{Secondary turns.}$$

Then, if the transformer is to be used on a 115-volt supply,

$$315 \times \frac{20}{115} = \text{approximately}$$

55 turns on the secondary.

8. The next item to be determined is the window space required for the secondary turns. Refer to Figure 2. Note that 55 turns of No. 6 wire require 2.2 sq. in. of window space.

9. The total window area can then be obtained by adding items 5 and 8, or

4.2 + 2.2 = 6.4 sq. in. of window opening.

This completes the preliminary design.

Final Values of Core Dimensions. If a variety of transformer sizes are to be built, various widths of transformer sheet will be needed. The width to be used should be such as to make the core cross section approximately square, although considerable deviation from this is permissible.

Item 4 shows that 2.2 sq. in. of core area are required. Obviously, this should be obtained by using a stack of 1.25-in. laminations 1.75 in. deep, or a stack of 1.5-in. laminations 1.47 in. deep. We will assume that 1.5-in. laminations are available.

Considerable variation is allowable in the choice of core height and width. In general, a height of 1.5 times the width gives a good proportion. These values can be read directly from the curves shown in Figure 3. Allowance has been made on these curves whereby the width of the window opening is increased slightly to permit the use of ducts. More will be said of the ducts in a later paragraph.

From these curves, for an area of window opening of 6.4 sq. in., the following dimensions are read:

Height = 3.10 in. Width = 2.30 in.

The completed dimensions of the core are shown at A in Figure 4. If desired, these dimensions can be "rounded off," that is, a 3⅛ by 2⅜-in. core could be used. In rounding off, however, do not reduce the dimensions, especially if the builder is inexperienced in winding coils. Only a reasonable degree of neatness in winding will permit the required number of turns to be placed in the opening provided.

Design of Coils. Two possibilities are open to the builder in arranging the coils on the legs of the core:

1. All windings may be put on one leg, the secondary being wrapped on the outside of the primary. If this is done, however, special care must be taken for cooling, since the heat generated in the inside of the winding is not readily dissipated unless air ducts are provided. In general, winding layers should not be "piled up" to a thickness of much more than 1 in. without providing a duct. This type of construction is shown in Figure 5.

2. One half of the primary winding may be put on each leg with one half of the secondary turns around each. This type of construction is shown in Figure 6. Care must be taken to see that the effect of the respective half-coils add to, rather than oppose, each other. However, this may be taken into consideration later when electrically connecting the coils.

The general procedure of winding the coils will be illustrated by the sample design. The builder may already be familiar with the method of winding coils for such purposes. If not, the following outline will be of assistance. Method 2, referred to in the foregoing, will be followed.

Since the legs of this transformer are 3⅛ in. long (inside clearance), a wood block about 2⅞ in. long should be used as a form on which to wind the coils. The other dimensions of this wood core should exceed those of the iron core by about ¼ in. as shown in Figure 4 at B. Add end pieces to make a spool, and wrap several layers of heavy paper around the center core. A layer of primary turns can then be wound around the spool. Wind as evenly and as flatly as possible, and count the turns on one layer. For the sample design given here, about 31 turns of No. 12 d.c.c. (double cotton covered) wire should be got into this space.

The total turns needed are 315, or 158 per coil. If five layers of 31 turns per layer are used on each coil, the total turns will be 155 per coil, or 310 for the primary instead of 315. Slight variation such as this is permissible over the preliminary figure. If the turns are wrapped with a double layer of cambric tape or paper after every 2 or 3 layers, the coil will have more neatness and rigidity. The several layers of each coil must all be wound in the same direction, otherwise one layer would neutralize another.

If, in wrapping, it is found that the piled-up layers are about 1 in. deep, and the coil is less than two-thirds wound, the ventilation of the coil will be greatly improved by adding wood strips, approximately ⅛ by ¼ in., as shown in Figure 5 and completing the winding on this added diameter. This process provides air ducts.

This particular coil will have a thickness of approximately ½ in. when the 155 turns are completed, hence no ducts are necessary.

The secondary winding will require 55 turns of No. 6 d.c.c. wire. This is equivalent to about 28 turns per leg. If wood spacers were not used in the middle of the primary coil, they should be added to the outside of the primary, and the 28 turns of No. 6 wire, which form the secondary wound over them. Two layers of 14 turns each will complete each secondary coil.

With a little care the completed primary and secondary coils as a unit can be slipped off one end of the winding spool. The process is then repeated to make coils for the second leg.

Constructing the Core, and Assembly. Figure 7 shows how one layer of laminations should be placed upon another so as to overlap the joints. It will probably be found most convenient to build up the three sides of the core complete as shown. When the required thickness is reached, the laminations should be clamped tightly together and the bottom crosspiece wound with several layers of cambric and friction tape. This will protect the insulation on the edges of the coil from injury. The coils are then slipped over their respective legs, but first each core leg should have sufficient insulating paper wound about it to hold the laminations tightly together. The paper may be held at the ends with friction tape. The coils should then slip easily onto the legs. The laminations of the fourth side of the core are then put into place one by one, staggered at the joints. They should then be clamped tightly together and wrapped, as were those on the other crosspiece. A mallet may be used to tap the laminations into line.

The next problem is how to hold the core rigid. Drilling the corners and putting bolts through them is not recommended, for burrs develop on the edges of the hole which make good electrical connections from one lamination to the other. They provide a path of low resistance for the eddy currents induced in the iron, hence cause losses and heating in the iron, and reduce efficiency. A convenient method of support is to clamp the top and bottom by the use of angle iron or channel as shown in Figure 6. Wood will also be satisfactory, and will furnish a base for secondary binding posts if desired.

The transformer is then completed by connecting the two halves of the primary winding in series. If these coils are not connected correctly (if the polarity is reversed) the turns of one coil neutralize the turns of the other, and practically a short circuit will occur when the two free ends are connected to the 110-volt supply. For this reason it is best to insert a 110-volt lamp in series with one of the leads. If the lamp lights, reverse one of the coil connections.

Connecting two halves of the secondary winding in series completes the construction. If the wrong ends are connected, no short circuit occurs, but the output voltage reduces to zero. Reversal of one coil will correct this. Obviously, the lead connecting the two secondary coils can be used as a half voltage tap. Hence, in our sample design, 20 volts may be obtained between secondary terminals, or 10 volts between either terminal and the common connection.

Transformers designed and constructed according to these standards will generally be found to operate at rated load continuously without overheating. However, for the larger sizes, immersion of the transformer in a suitable tank of transformer oil will be found to aid in the dissipation of the heat, although this in general is unnecessary for transformers of this type and rating.

The Materials. Iron cores should be built up of electrical sheet, No. 29 gauge, approximately 0.014 in. thick. This may be obtained from a number of steel companies. These companies also supply information on the core loss (eddy current and hysteresis) to be expected when their material is used at a certain value of flux density (i.e., when the number of flux lines per square unit of cross section do not exceed a certain amount). These losses are calculated at a flux density of 10,000 flux lines per square centimeter, or 64,500 lines per square inch. The design procedure given here results in this density. Hence, if the iron core of a transformer weighs 7 lb. and is built of sheet with a manufacturer's guarantee of 1.2 watts per pound at 60 cycles and rated flux density, the core loss will be $7 \times 1.2 = 8.4$ watts. This means that the transformer will take at least 8.4 watts from the supply line at all times. Losses vary from .75 to 1.4 watts per pound for the various grades of sheet usually available. The sheet can be purchased ready cut to size.

The window space provided in these transformer cores is sufficient to accommodate the windings if d.c.c. magnet wire is used. Single cotton-covered or other wire is not recommended.

In standard practice, Fuller board and press board are used as insulation around the cores of transformers before the winding is slipped on. In these designs, however, a good grade of wrapping or drawing paper wrapped tightly around the iron core as previously indicated will serve to prevent the edges of the iron from cutting through the wire insulation. This paper can also be used between layers of the winding itself. Cambric tape and friction tape are also satisfactory as insulation between layers, and may be used to hold the outside turns of the coils in place.

Problems and Projects

AIRPLANE LANDING-GEAR FITTING

A. P. Lantis, Air Corps Technical School, Rantoul, Illinois

(See Supplement No. 310)

The airplane landing-gear fitting makes a very interesting problem for the mechanical-drawing room. It is one of the very best exercises the writer ever used for teaching the proper method of laying out centers and the drawing of tangents. To obtain the best results the drawing should be made at least twice its actual size.

It can also be used as a problem in the metal shop.

COLONIAL HANGING WALL BOOKSHELF

Franklin H. Gottshall, Scotch Plains, New Jersey

(See Supplement No. 311)

The colonial table shown in connection with the colonial hanging wall bookshelf in the halftone, appeared in the March, 1935, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

The colonial hanging wall bookshelf illustrated and described herewith, with four scalloped sides, is quite decorative. Like the designs of many colonial pieces, compass curves are used in its ornamentation. These, while more mechanical than freehand curves, give a certain quaintness to this design. The mechanical curves also are relieved considerably by the freehand curves used in the design of the top.

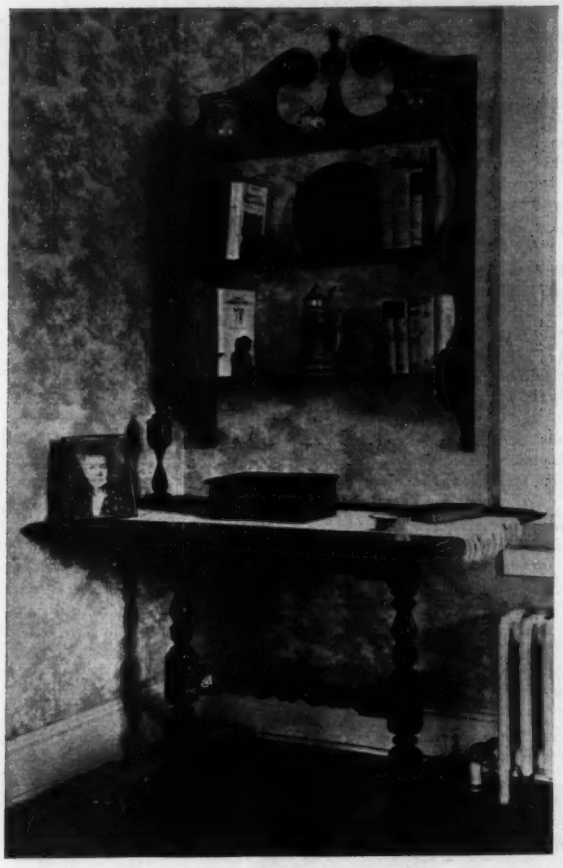
Method of Procedure

Dress all stock, preferably oak or walnut, to the required over-all size. Lay out the places where the mortises are to be cut in the side. Cut these mortises and then fit snugly.

Next, lay out patterns for the shapes of the sides and the top. The patterns may be made of brown manila paper. Lay out, then cut the shapes on the band or jig saw. Be very careful to get the two sides alike, and keep the edges sharp. This will require careful truing up with a file and sandpaper block, but the sharp, clear-cut profiles that result as a consequence of careful work will well repay the effort required. The ornament at the top consists of two carved scrolls adapted from the Ionic scroll of the Ionic order of architecture. They may be laid out by drawing four concentric circles, and then joining these, correcting the lines at the proper places to form the volute. They are carved by cutting along the lines with a sharp knife or a carver's V tool, and then forming the grooves with a shallow gouge. After these have been carved and sanded, the shelves may be glued and assembled. Care must be observed to properly square the shelves when they are being clamped.

After the finial has been turned, it must be split, or flattened on the back to allow the shelves to fit against the wall. Only the urn part of the finial needs flattening. After carving, it may be fastened to the shelves. The finial is formed like a classic urn with a flame carved on the top.

Finish with a coat of oil stain, followed by an application



of filler. Allow this to dry, when rubbed off, for 24 hours; then apply a thin wash coat of shellac. This should be steel-wooled lightly after 24 hours of drying, and followed by two coats of a good grade of 4-hour floor varnish. The final coat of varnish should be rubbed down with pumice stone and oil. After several days have elapsed, this may be followed by an application of wax.

SOCKET WRENCHES

F. N. Newton, Jr., Senior High School, Sharon, Pennsylvania

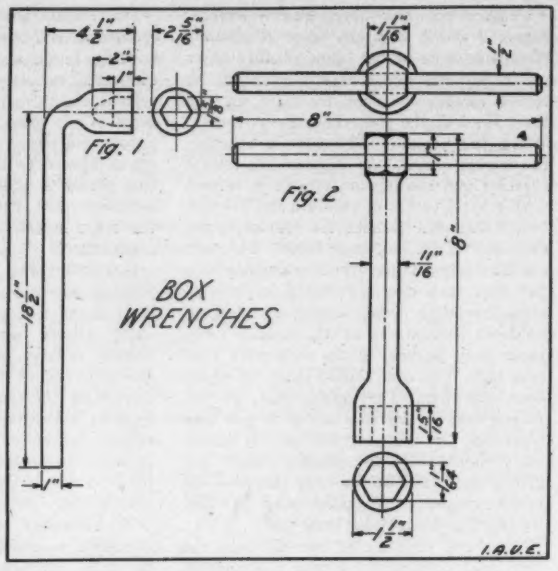
The two projects described in this article, may be used as problems for the mechanical-drafting room, the machine shop, or for the forging shop.

The material used for the socket wrenches should be tool steel.

Heat a round bar of steel and then hammer it out to its approximate shape. Drill a hole into the end of the piece slightly smaller than the distance across the flats of the nut for which the wrench is being made. Again heat the end, and swage out the hole by driving a hex-shaped piece of tool steel slightly smaller than the finished nut size into it. This first swage should have a little taper so it will come loose readily after having been driven into the hole. The last swage used must be the exact size of the nut, and not tapered.

After this operation, the handle is forged to the shape shown in Figure 1.

For the T-handled socket wrench, the various operations are practically the same, except that after the first hole is drilled into the socket, a flat-bottom drill must be used to drill the bottom of the hole flat. The T handle on this wrench should be slightly tapered and tightly driven into the hole drilled in the head of the socket wrench.



A project for the machine shop

BIRD-FEEDING SHELTER

John H. Hills, Narberth, Pennsylvania

The bird-feeding shelter described herewith, and shown by the accompanying illustrations, is an appealing project for the bird-loving junior-high-school pupil.

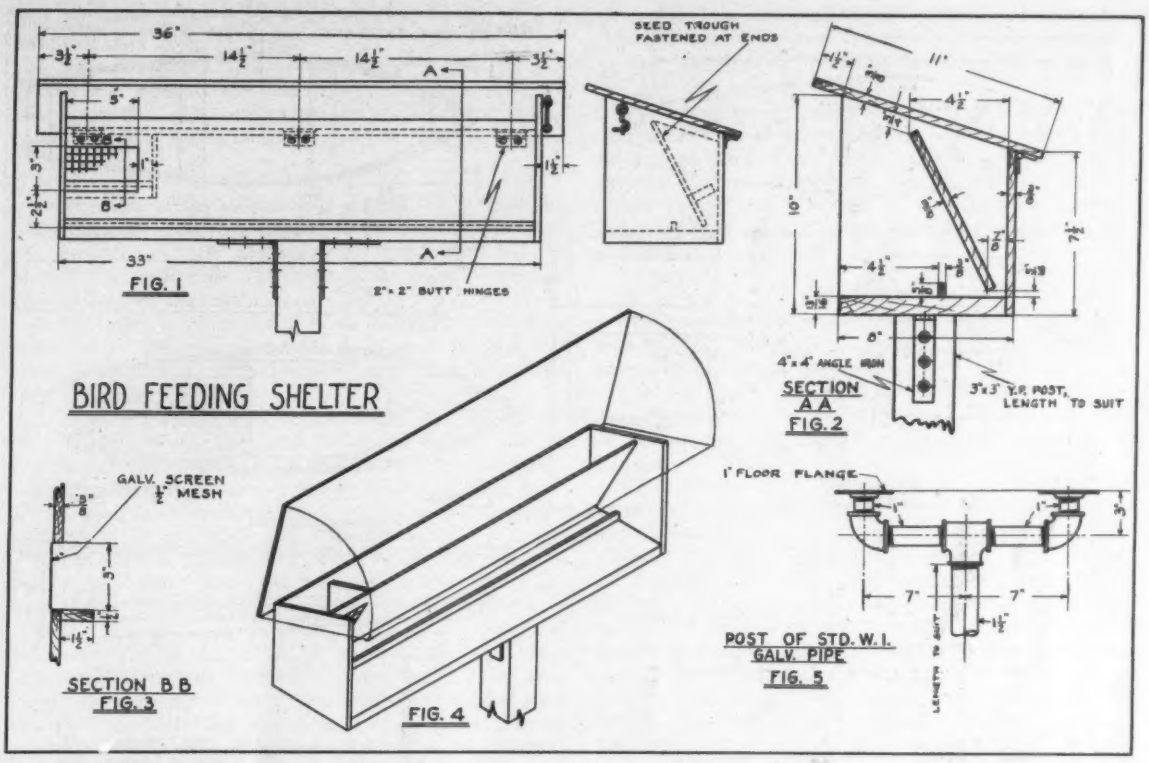
The shelter is closed at the ends and top, but the front is open. By raising the roof, hinged at the back, food may be placed into the seed trough. This has a 5/16-in. opening at the bottom through which the seed drops to the platform, but is prevented from working too far forward by a ⅜ by ⅝-in. stop strip. A hook and eye holds the roof securely closed in windy weather. At the left end is a 3 by 5-in. opening protected by ½-in. mesh screen, behind which may be placed pieces of suet, always a choice morsel to birds in cold weather.

Any suitable kind of wood may be used. Cypress is recommended, as it withstands so well the rigors of the elements. The shelter is an open-all-the-year restaurant, but is a special attraction to birds when the ground is snow-covered and their natural sources of food supply are denied them.

Figure 1 shows the front and end elevations with sufficient notes and dimensions, in conjunction with the cross section of Figure 2, to furnish working instructions. Figure 3 is another cross section showing details of the suet holder. One-inch brads may be used for fastenings, although No. 6 by ⅞-in. brass screws are better.

Two methods are shown for supporting the shelter. The cheaper one is to use a 3 by 3-in. yellow-pine post, fastened

The bird-feeding shelter ready for use; also in the "open" position for filling with grain and suet



with two angle irons. This has a disadvantage, in that it will attract cats and squirrels to the feasting board, and thus discourage the birds. A better but more expensive post is made of standard galvanized pipe and fittings. It is shown in Figure 5. Whichever post is used it should be planted from 15 to 18-in. in the ground, and preferably set in concrete. The height of the shelter above the ground can be adjusted to suit the builder, but it must be remembered it will attract prowling animals if it is too near the ground.

Bill of Material

1 pc. 36 x 13/16 x 8	Cypress
1 pc. 36 x ⅜ x 11	Cypress
1 pc. 72 x ⅜ x 8	Cypress
1 pc. 36 x ⅜ x 5⅛	Cypress
1 pc. 6 x ½ x 1½	Cypress
1 pc. 3 x 3 — 7 to 8 ft.	Yellow-pine post
1 pc. 4 x 6	½-in. Mesh galvanized screen
2 pc. 4 x 4	Angle irons, brass or galvanized
3 pc. 2 x 2	Butt hinges, brass
1 pc. 2-in.	Hook-and-eye screw, brass
¼ lb. 1-in.	Brads
4 doz. No. 6 x ⅞-in.	Screws, brass
1 pt.	Outside paint, color as desired

If a metal post is used instead of a wooden one, the following standard galvanized pipe and fittings are required:

2 pc. 2-in.	Nipples, 1-in.
2 pc. 5-in.	Pipe, 1-in.
1 pc. 7 to 8 ft.	Pipe, 1½-in.
2 pc. 1-in.	Ells
1 pc. 1 x 1 x 1½	Tee

A THREE-IN-ONE BOAT

Leonard Wright, Public School No. 30, Jersey City, New Jersey

A child easily tires of a plaything and soon wishes that his toy were something different; that it could do new things, or that it could be changed into something else.

The model boat here described, is a rowboat, a motorboat, and a sailboat, all in one. As a rowboat, it is strong but light. It will float nicely; it may be filled with water or sand, or it may be towed back and forth with small doll figures on the seats.

If a motorboat is desired, the transformation is easily effected by fastening a deck and a bottom to the rowboat, slipping an outboard spring motor in place, and you have a boat that will go by itself through the water.

If a sailbóat is desired, a sailboat deck and keel are fastened to the rowboat, and everything is ready for a nice sail.

These simple changes can be made with a screw driver and three screws each for the decks and the bottoms.

The Rowboat

1. Trace and cut the plan of the bottom from a piece of ¼ by 4 by 13-in. basswood.

2. For the stem, square up a piece of poplar, ¾ by 1 by 2 in. Then cut the angle on one end, and afterward trace the shape of the bow on this angle cut, and plane the piece to the shape of the bow.

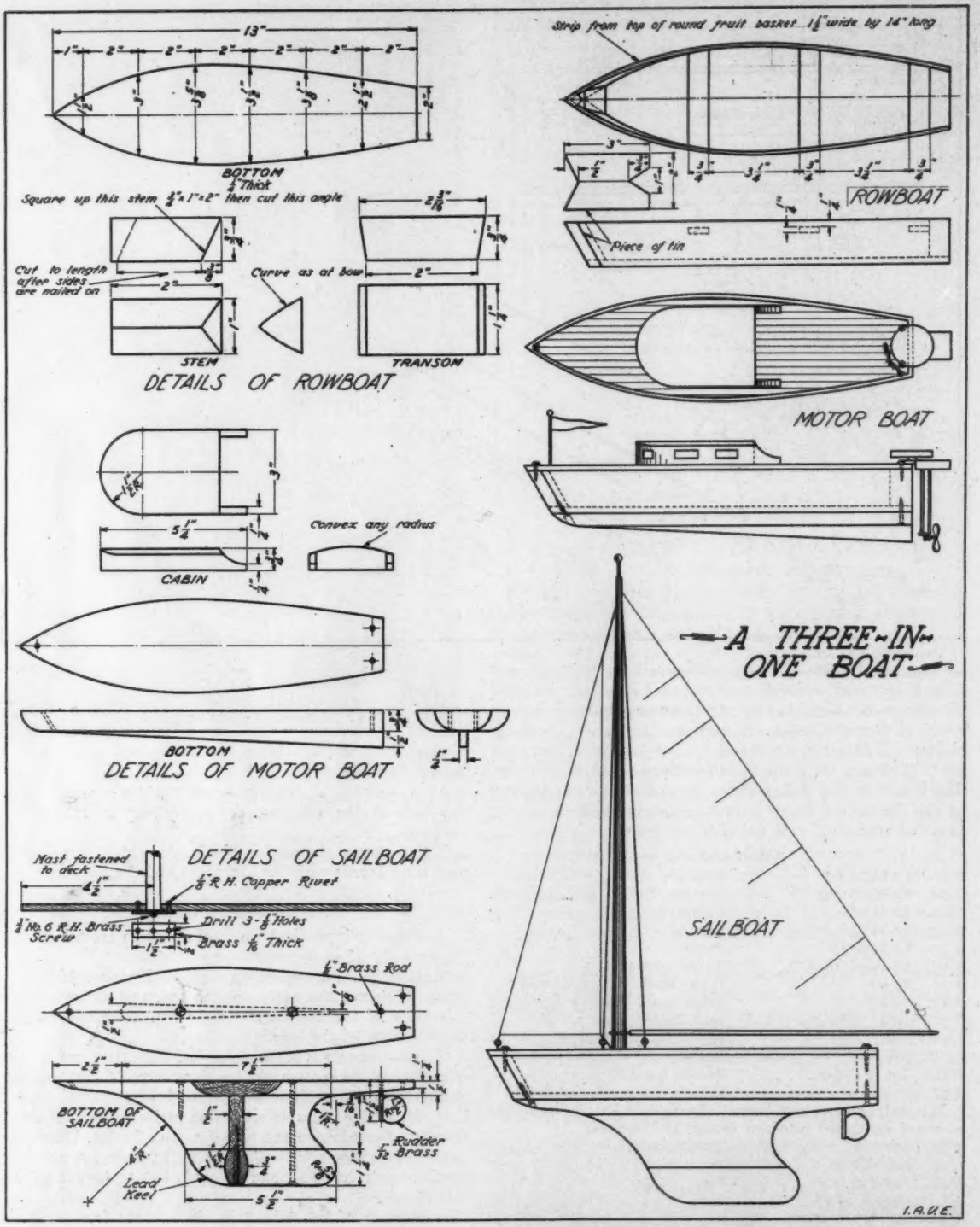
3. The transom is made of poplar. Both stem and transom are glued to the bottom piece with waterproof glue, and reinforced with two or three well-placed brads.

4. Make the sides of two thin strips of wood, 1½ by 14 in., salvaged from the top of a fruit basket. When these strips have been well soaked in water, they are glued and nailed firmly in place, and the ends left to be cut off flush afterwards.

5. A piece of tin, 2 by 3 in., is next cut from a tin can. A V-shaped piece is cut out at each end, as shown in the illustration. The tin is then folded around the bow and nailed over the top of the stem and over the bottom. It should be fitted snugly to the sides, as this adds much strength to the whole bow.

6. The three seats are ¼ by ¾ in. They are to be fitted to the sides and fastened in place with thin brads.

7. The rowboat is then finished by sandpapering all parts and painting the inside with two coats of yellow enamel and the outside with two coats of red enamel.



The Motorboat

1. Trace the deck of the motorboat on a piece of ¼-in. basswood. Fit it carefully. Locate three screw holes by means of a paper template so that similar screw holes may be located on the sailboat deck.

2. The cabin may be a piece of pine cut to shape, and fastened to the deck with glue and brads, 4 in. from the bow.

3. Paint the deck with yellow enamel, and then with a sharp pencil, draw lines ¼ in. apart, parallel to the center line, to represent deck boards. The sides of the cabin are also painted yellow. Windows and portholes may be represented by small squares and circles of tinfoil pasted in place. The curving top of the cabin is painted black.

4. The bottom of the motorboat is a piece of pine ¾ in. thick, with the plan of the bottom of the rowboat traced upon it and carefully shaped to a nice fit. The lower edge is well rounded, forming a sharp line at the bow. Locate the three screw holes by a paper template so that similar holes

may be made in the sailboat bottom. The bottom may be enameled dark green or black.

5. The outboard motor for the motorboat may be purchased in a ten-cent store and fitted to the deck so that it will pivot, thus eliminating the need for a rudder. An inboard electric or spring motor also may be fitted to the boat.

The Sailboat

1. The deck of the sailboat is a piece of ¼-in. basswood, fitted carefully to the top. Locate the three screw holes from the template used for the motorboat deck. Bore a ½-in. hole on the center line, 4½ in. from the point of the bow for the foot of the mast.

2. The mast is 17 in. long, ½ in. diameter at the base and 3/16 in. diameter at the tip. It is made of pine. The boom is 11 in. long, ¼ in. diameter at the mast and ⅛ in. diameter at the tip.

3. The sail is a right angle, with a 10½ in. base and an altitude of 16 in. Sew a ¼-in. hem all around the sail. The jib is a right triangle with a 3½-in. base, and a 13-in. altitude.

4. The rigging stays are of fish cord through ⅛-in. brass screw eyes placed as in the drawing. The mast is strongly fastened to the deck as shown in the illustration.

5. The deck is painted with yellow enamel and the deck boards are shown just as was done for the motorboat. The mast and boom are varnished with clear outside varnish.

6. The bottom of the sailboat is a piece of ½-in. pine, fitted carefully to the bottom of the rowboat. The lower edge is well rounded, forming a sharp line at the bow. Locate the three screw holes from the paper template used for the motorboat. The keel is a piece of ½-in. pine or poplar, laid out and shaped as in the illustration, and fastened to the bottom with glue and screws. The lead ballast part of the keel is made by hollowing two half-molds out of wood. The two halves are then clamped into a vise, and the lead poured. The holes for the screws are formed by standing two 8d nails upright in the mold.

7. The rudder is made of sheet brass shaped as shown and soldered to a piece of ⅛-in. brass rod long enough to go through the bottom. It must be bent over at the top to prevent the rudder from falling out. The rod should fit snugly in the hole. The bottom of the sailboat should be enameled dark green or black. The brass rudder should be polished.

Conclusion

The three-in-one boat should now consist of five parts; namely, the rowboat, the motorboat deck and bottom, and the sailboat deck and bottom.

Use 1-in. No. 8 r.h. brass screws to fasten the decks to the rowboat, and 1¼-in. No. 8 f.h. brass screws to fasten on the bottoms. This method makes all parts secure, and all parts easily changed.

The water line of the motorboat and the sailboat will automatically appear with different colors of the rowboat sides and the bottoms.

To fit the deck closely to the rowboat, the camber at the top edge of the sides may be straightened with a plane, or better, on a sandwheel, before the tin cover of the bow is in place. The joint of the deck and the rowboat may be made leakproof by cementing a soft-rubber gasket all around the top inner edge of the rowboat.

If the transom is desired to be wider at the top than the bottom, thus making the boat more shapely, lengthen the top dimension of the transom by ½ in., and cut the double angle with the backsaw.

AN ALUMINUM WEATHER VANE

M. V. Churchill, Pittsburgh, Pennsylvania

To make the weather vane described herewith, the following materials are required:

1 pc. 1 ft. spare	No. 14 B & S gauge sheet aluminum
1 pc. ¼ by 60 in.	Aluminum rod
1 pc. 5/16 by 12 in.	Aluminum rod
1 pc. 7 by ½ in. O.D.	Aluminum tubing
1 pc. ⅜ by ½ in.	Aluminum rod
1 pc. ½ by ¾ in.	Aluminum rod
1 pc. 1¼ by ⅝ in.	Aluminum rod
1 pc. ⅛ by 3 by 3 in.	Aluminum plate
1 pc. 1/32 by 30 in.	Aluminum wire
3 ⅛ by ½-in.	Button-head aluminum rivets
1 ¼ by ½ in.	Aluminum setscrew

Aluminum is used for this project because it not only is ornamental, but also resists rust and corrosion. Besides this, aluminum is a very light metal and the aluminum weather vane will yield to the lightest breeze. The light-colored aluminum also is readily visible and contrasts pleasantly with the sky or with some dark background.

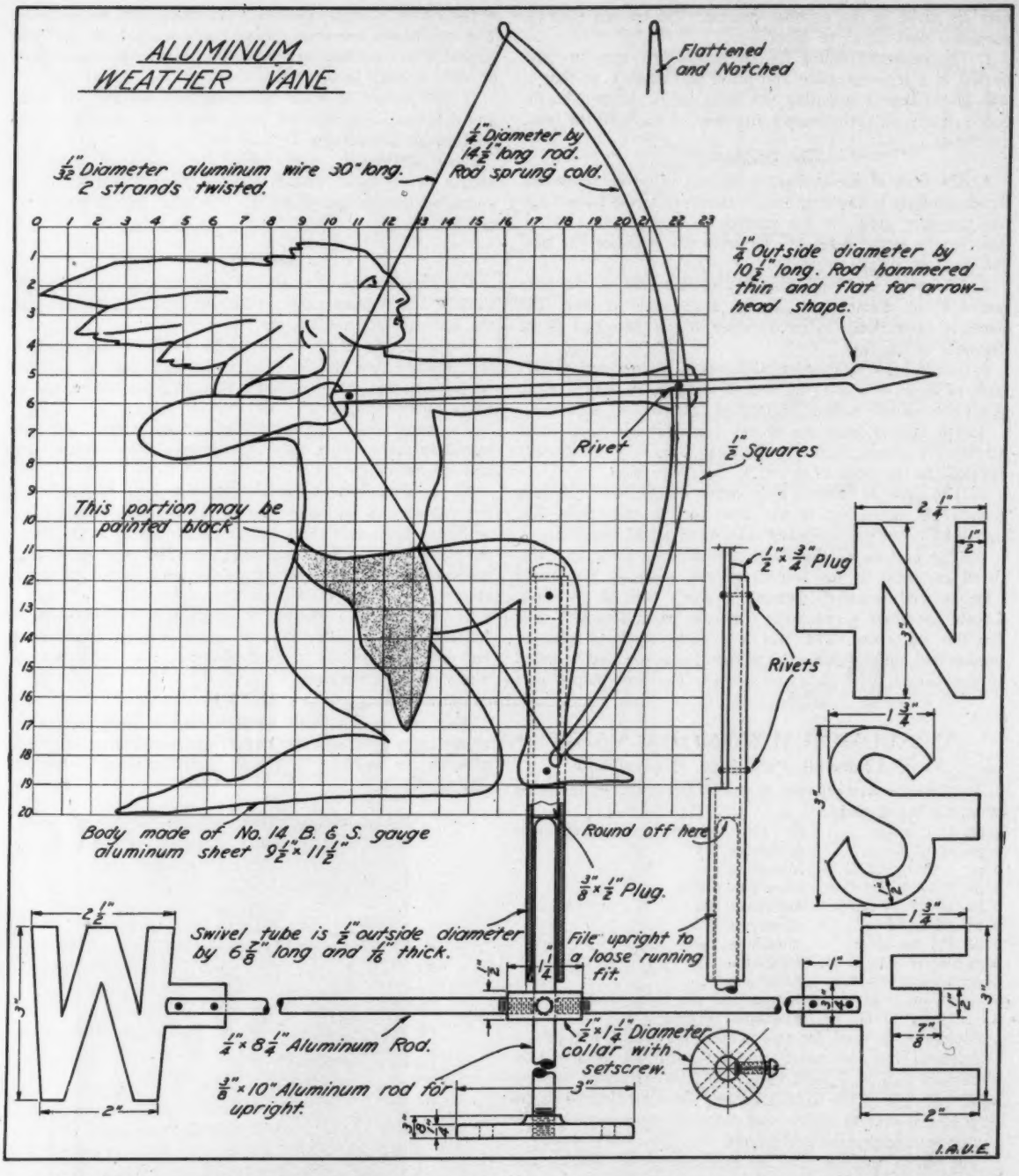
The bill of material calls for aluminum rivets, screws, and wire. These are used because joints between dissimilar metals have a tendency to loosen under exposure to the weather unless specially protected.

The figure of Chief Smoke-in-the-Eyes may be drawn freehand on the 14-gauge aluminum or a template for the figure may be laid out on paper from the squared sketch shown in Figure 1, and then transferred to the sheet. The outline should be drawn in with a hard pencil and as a safety measure, a second line about ⅛ in. outside of the first should be drawn. Saw out the figure according to the outside line with a fret saw and then trim it down to the first line with a file. Do not try to turn sharp curves, such as are found in the feather headdress and the back of the knees, with a fret saw. Approach them from two directions. The details of the face and the knuckles of the hands may be put in with a file.

Next cut out the letters N, E, W, and S, using the remains of the 14-gauge aluminum sheet. They should have ½ by 1-in. tabs left on one side to permit fastening them to the four direction arms.

Aluminum weather vane

For the base, cut the piece of ⅜-in. plate into a disk 3 in. in diameter. Drill a 9/32-in. hole in the center, being careful to get it exactly perpendicular, for if it is a little off, the top of the weather vane will be decidedly out of plumb. Tap out the hole to receive the ⅜-in. upright. The base illustrated was turned out on a lathe and has a raised collar, but if a lathe is not available, the ⅜-in. plate will do. Drill and countersink four ¼-in. holes about ½ in. from the outer edge. These are


ALUMINUM WEATHER VANE
Flattened and Notched
1/4" Diameter by 14 1/2" long rod. Rod sprung cold.
1/32" Diameter aluminum wire 30" long. 2 strands twisted.
1/4" Outside diameter by 10 1/2" long. Rod hammered thin and flat for arrow-head shape.
Rivet
1" Squares
This portion may be painted black
1/2" x 3/4" Plug
Rivets
Body made of No. 14 B. & S. gauge aluminum sheet 9 1/2" x 11 1/2"
Round off here
3/8" x 1/2" Plug.
Swivel tube is 1/2" outside diameter by 6 7/8" long and 1/16" thick.
File upright to a loose running fit.
1/4" x 8 1/4" Aluminum Rod.
1/2" x 1 1/4" Diameter collar with setscrew.
3/8" x 10" Aluminum rod for upright.
I.A.V.E.

for the four wood screws with which the base is to be fastened down. If the surface on which the weather vane is to be mounted is not level, a small subbase of wood, furnishing a level surface large enough for the base of the weather vane, must be made. This support should be large enough to be firm but not so large that the support rather than the weather vane will be seen.

The upright consists of a piece of 3/8 by 10-in. rod threaded to fit the base at the lower end and rounded at the top to furnish a bearing for the revolving part. Three inches of the upper end will have to be filed slightly to make loose turning fit in the swivel tube. The four direction arms each require a 1/4 by 8 1/4-in. piece of aluminum rod. They are threaded at one end and have a 1/16 by 3/4-in. slot at the other end into which the letters N, E, W, S are riveted. The four arms screw into a hub made of a short piece of 1 1/4-in. rod. The hole through the center of this hub is to be 3/8 in. The holes for the 1/4-in. direction arms should next be drilled and tapped. Care should be taken to get the north and south rods exactly at right angles to the east and west rods. A fifth 1/4-in. tapped hole should be placed midway between two of the others, this to be used for the 1/4-in. aluminum setscrews.

The bow is made of a piece of 1/4 by 14 1/2-in. aluminum rod. This is bent by hand to a graceful curve as shown in the illustration. It is then placed flatwise on the anvil surface and both tips are hammered flat. The edges of the flattened portions are rounded off and a notch is filed in the forward side, about 1/4 in. from each end. These notches are to receive the bowstring.

The arrow is made out of a piece of 1/4 by 10 1/2-in. alumi-

num rod. A notch is filed for the bowstring on one end and the other end is flattened out on the anvil and then filed to the shape of an arrowhead. It will lend grace to the arrow if the shank is tapered for a short distance toward the head. Turn the arrowhead over during the forging operation so that each side receives about the same amount of hammering.

The swivel tube consists of a piece of ½-in. O.D. tubing, 7 in. long. This is placed upright in a vise and split with a hack saw for a distance of 3½ in. Then by making a crosscut halfway through the tubing to the bottom of the saw slits, one half of the tube is removed.

Drive a plug of ⅜ by ½-in. aluminum rod into the tube at the point where the cutaway part begins. This plug is the bearing proper which will rest on the rounded end of the upright rod.

To give a finished appearance to the top as well as to prevent the tube from flattening when the figure of the Indian is riveted to it, it is necessary to fashion a short plug out of a piece of ½ by ¾-in. aluminum rod. After this plug has been made, the top should be rounded off and then the plug itself is sawed in half, lengthwise. The lower part of the plug, of course, must be turned or filed down to fit into the swivel tube.

The first step in the process of assembly consists of marking the locations for the aluminum rivets with a center punch. The ⅛-in. holes are then drilled through the following points: Two holes in the arrow, 6 in. apart, center to center, the first one to be ½ in. from the bowstring end of the arrow. The holes in the arrow are then used for laying out the holes to go through the Indian's hand and bow. Two ⅛-in. holes are then drilled in the Indian's forward leg. These are to be 3½ in. center to center, the first one to be ¼ in. above the sole of his foot. The silhouette of the Indian is used as a template for locating two corresponding holes in the split portion of the swivel tube, the lower one to be ¼ in. above the point where the tube is crosscut. The upper hole should be drilled through the half plug.

The next thing is to rivet the Indian's leg to the tube, then the bowstring end of the arrow to what seems to be the Indian's collarbone but is really the right hand which does not appear in the silhouette. Then drive the longer rivet through the arrow, the bowstring, and the left hand in the order given.

A word on driving the rivets. Assemble the work temporarily with bolts except at the spot which you are about to rivet. Tap the rivet through the hole somewhat in the manner of starting a nail. Draw up the joint until all parts are in contact. Then file the rivet down to ⅛ in. clearance. It will help to spread the rivet properly if a dent with a center punch be first made in the center before starting the riveting. Place the rivet head on the anvil surface and using a hammer and a rivet set, put another head on the other end. This process called "upsetting" may be done with several solid hammer blows.

To assemble the direction arms, drill two ⅛-in. holes in the tabs on the letters and in the slotted ends of the rods about ⅝ in. apart. Be sure to rivet the letters on to the arms so that they appear in the correct order.

The bowstring is made of aluminum wire. Bend the wire double and put a fairly close spiral twist in it. Make a loop at each end and place them in the bow notches. Pull the wire back just far enough to clear the end of the arrow and let the slight spring of the bow bring it into the notch.

To place Smoke-in-the-Eyes on the roof top, screw the base down to a solid wood surface and then screw the upright rod into it. If it is a windless day, the weather vane may be leveled by a series of twirls. Place the Indian on the upright and give him a slight spin with the hand. If the arrow has a tendency to settle in any one direction when there is no wind, the upright rod is not plumb. In that case, bend the shaft slightly in the direction in which the arrow tends to point and then try it again. The upright may also be plumbed by checking it in two planes at right angles with a spirit level. Slip the hub of the direction arms over the upright rod and set it at the right height and direction by means of the setscrew. Put the Indian in place and the weather vane is finished.

SOME MORE ABOUT THE CO-OPERATIVE VACATION SCHOOL

H. H. Braucher, University of Illinois, Urbana, Illinois

The trip outlined on page 132 of the April, 1935, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION might start, say, from Chicago, or any other convenient gathering place. If we assume Chicago to be the starting point, the Furniture Mart might be chosen for the first visit. It lends itself admirably for a study of furniture design and construction. Several days more might be spent in Chicago to study other branches of industry.

Going east, Hammond, Gary, Grand Rapids, and Detroit would open excellent fields for investigation. In order not to make the schedule too strenuous, rest stops in the woods and rural districts en route might be made.

If, instead of going east from Chicago, the study group would head west or north, much interesting material of a different kind but of equal value might be found. For instance, Milwaukee, with its different types of schools and its diversified industries would offer many points worthy of investigation. Madison and its university might be visited. The lumbering industry might be studied. On this route, too, there are many opportunities for recreation and rest. The U. S. Forestry Laboratory at Madison no doubt would be of interest to every shopman.

Going still farther west, Minneapolis, St. Paul, and other places of interest would be worth visiting.

Of course, groups of teachers might start from their own home town and plan their own trips. In order to help organize one or more of these co-operative vacation-school ventures, the writer will be willing to serve as correspondent to interested parties. It will be necessary, however, in every case to enclose an addressed and stamped envelope. Teachers communicating with the writer will have to act promptly. They should indicate the cities they would like to visit and the subjects that would interest them. Also the time they would have to devote to this venture, and whether they intend to make the trips during July or August, and the method of transportation which they would prefer or suggest. From these letters it may be possible to arrange some schedule or schedules which can be profitably followed in trying out the scheme of arranging a co-operative vacation course for the coming summer.

HOPI TIHUS

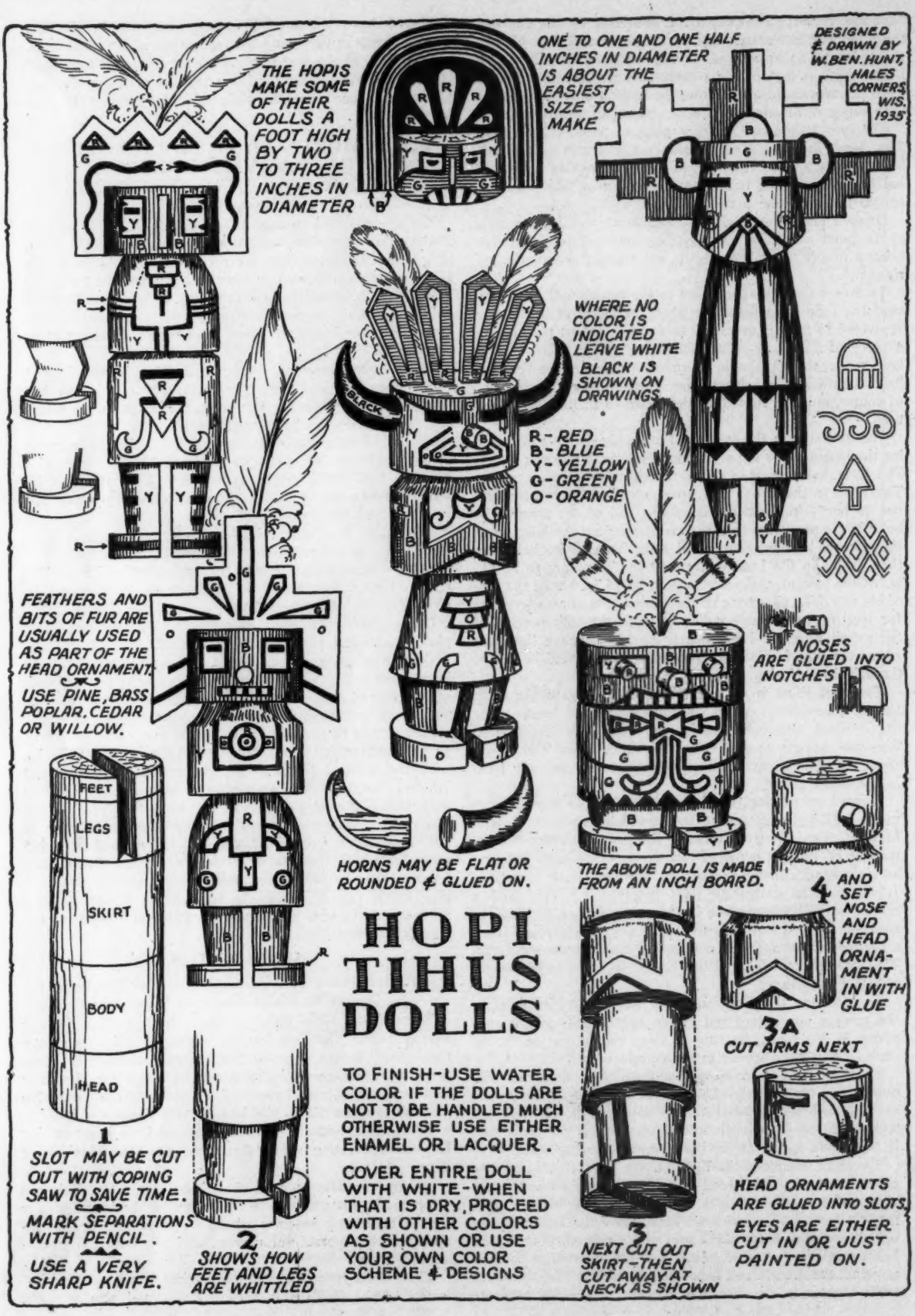
W. Ben Hunt, Handicraft Instructor, Boy Scout Troop 98, Hales Corners, Wisconsin

These funny little dolls are made by the Hopi Indians shortly before the final katcina ceremony. The men busy themselves in the kiva or underground ceremonial house preparing their costumes, and making tihus for the little girls, and small red bows and arrows for the boys. No children are allowed in the kiva at this time.

The final katcina is called the "nimon," or home-coming katcina, and comes about a month before the Hopi snake dance each year.

During the afternoon of the nimon, the tihus dolls are given to the little girls. The tihus may be the image of any one of the many katcinas which are secondary deities endowed with supernatural powers, and are largely clan ancestors.

Tihus dolls serve two purposes. They serve as an object lesson to the children in their religion, and also as dolls.


THE HOPIS MAKE SOME OF THEIR DOLLS A FOOT HIGH BY TWO TO THREE INCHES IN DIAMETER
ONE TO ONE AND ONE HALF INCHES IN DIAMETER IS ABOUT THE EASIEST SIZE TO MAKE
DESIGNED & DRAWN BY W. BEN. HUNT, HALES CORNERS, WIS. 1935
WHERE NO COLOR IS INDICATED LEAVE WHITE
BLACK IS SHOWN ON DRAWINGS.
R - RED
B - BLUE
Y - YELLOW
G - GREEN
O - ORANGE
FEATHERS AND BITS OF FUR ARE USUALLY USED AS PART OF THE HEAD ORNAMENT.
USE PINE, BASS POPLAR, CEDAR OR WILLOW.
NOSES ARE GLUED INTO NOTCHES
HORNS MAY BE FLAT OR ROUNDED & GLUED ON.
THE ABOVE DOLL IS MADE FROM AN INCH BOARD.
HOPI TIHUS DOLLS
TO FINISH - USE WATER COLOR IF THE DOLLS ARE NOT TO BE HANDLED MUCH OTHERWISE USE EITHER ENAMEL OR LACQUER.
COVER ENTIRE DOLL WITH WHITE - WHEN THAT IS DRY, PROCEED WITH OTHER COLORS AS SHOWN OR USE YOUR OWN COLOR SCHEME & DESIGNS
FEET
LEGS
SKIRT
BODY
HEAD
1
SLOT MAY BE CUT OUT WITH COPING SAW TO SAVE TIME.
MARK SEPARATIONS WITH PENCIL.
USE A VERY SHARP KNIFE.
2
SHOWS HOW FEET AND LEGS ARE WHITTLED
3
NEXT CUT OUT SKIRT - THEN CUT AWAY AT NECK AS SHOWN
3A
CUT ARMS NEXT
4
AND SET NOSE AND HEAD ORNAMENT IN WITH GLUE
HEAD ORNAMENTS ARE GLUED INTO SLOTS.
EYES ARE EITHER CUT IN OR JUST PAINTED ON.

The little Indian girls carry them around in miniature cradles just as white children do with their dolls. The tihus are usually made of branches or small trees of some soft wood, but as the green wood takes quite some time to season, it is much more convenient to make them of one of the soft woods obtainable at any lumber company. Woods such as white pine, sugar pine, spruce, cedar, bass, or poplar are very easy to whittle.

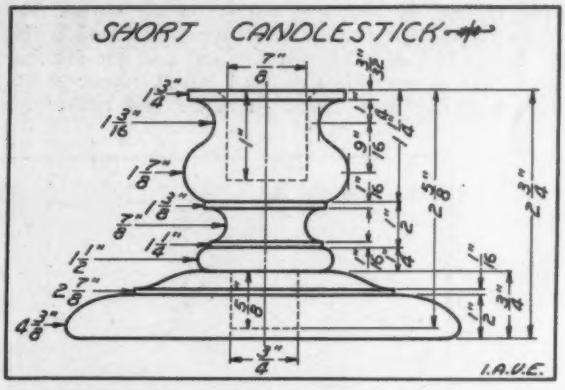
TABLE LAMPS AND A CANDLESTICK

C. R. Wells, Luther L. Wright High School, Ironwood, Michigan

The accompanying illustrations show two designs of small table lamps that are very pleasing to the students.

Table lamp No. 1 needs no further description.

Table lamps



On table lamp No. 2, some collar carvings have been added. These carvings consist of two pieces which must be fitted around a dowel and glied in place after all the turning on the base is completed.

If one cares to save material, ¾-in. lumber may be used for the base, with a block glued in the center to form the dowel. The stems should be made of two pieces.

In placing the ⅛-in. bushing in the base, it is quite often necessary to locate it on a curved surface. To make a neat-appearing job, under these conditions, counterbore with a 9/16-in. auger so that the bushing sets into the wood.

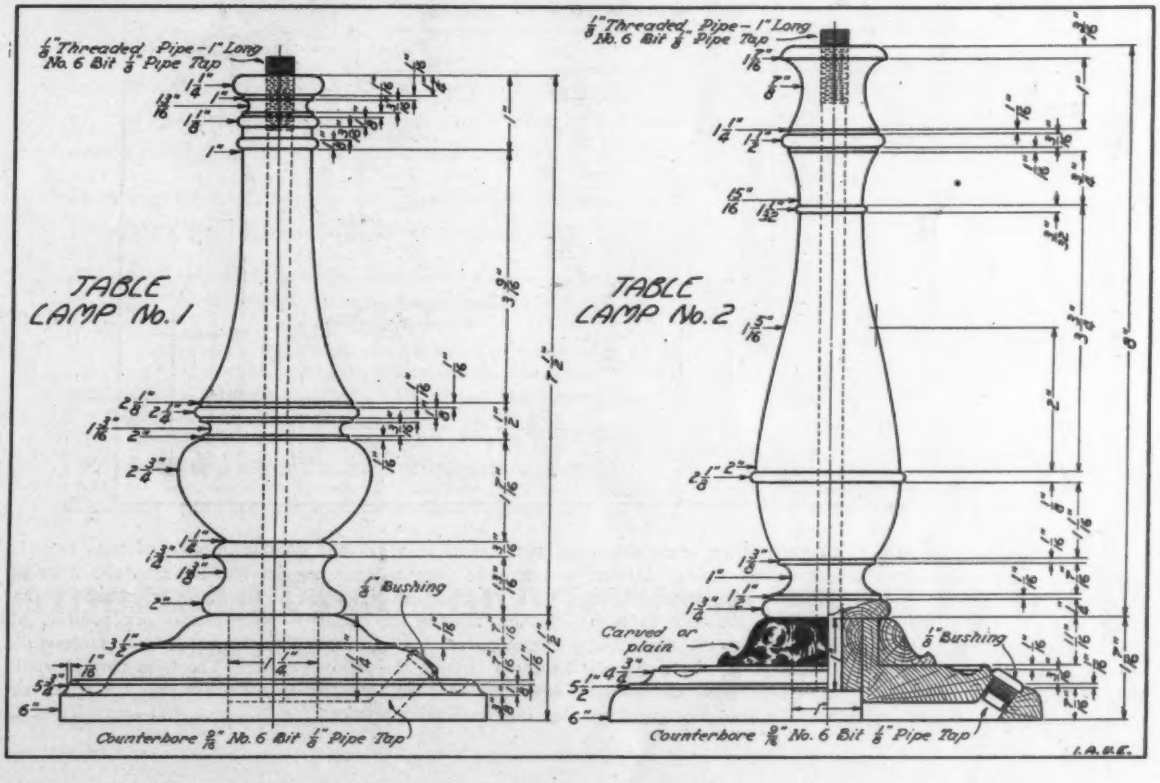
The chain pull, plug, and 10 ft. of cord may be obtained at any electrical supply store, hardware store, or ten-cent store. The collar carvings may be bought from manufacturers of this type of ornamentation.

The short candlestick also will be found to be a good turning project.

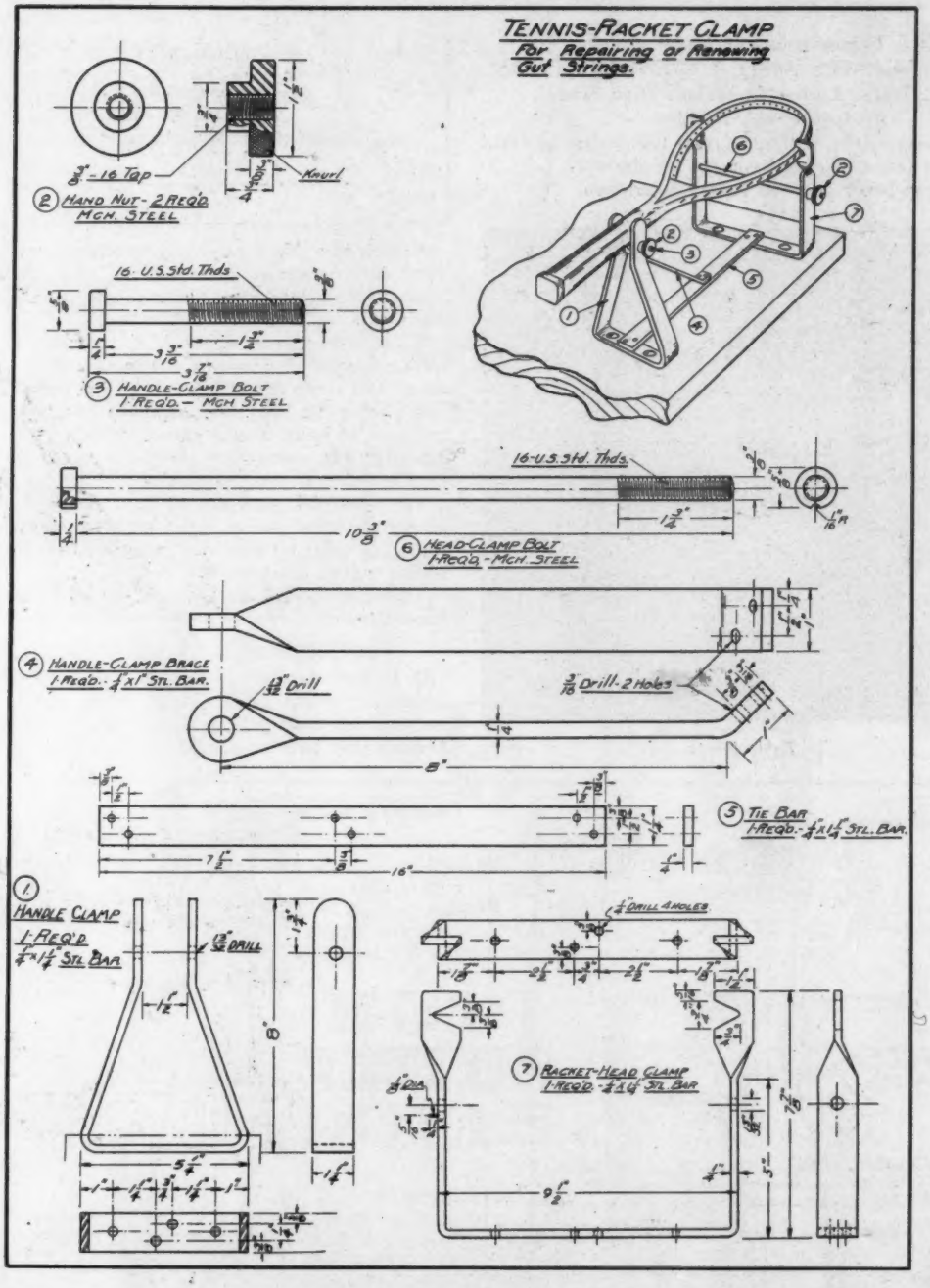
TENNIS-RACKET REPAIR CLAMP

D. E. Kellogg, East High School, Erie, Pennsylvania

Amateur tennis players, who try to service their own rackets, are frequently not successful in their attempts, because they have no suitable means of holding the racket


⅛" Threaded Pipe – 1" Long
No. 6 Bit ⅛" Pipe Tap
TABLE LAMP No. 1
⅛" Bushing
Counterbore 9/16" No. 6 Bit ⅛" Pipe Tap
⅛" Threaded Pipe – 1" Long
No. 6 Bit ⅛" Pipe Tap
TABLE LAMP No. 2
Carved or plain
⅛" Bushing
Counterbore 9/16" No. 6 Bit ⅛" Pipe Tap
I.A.V.E.

while putting the necessary tension on the strings. The design for the tennis-racket repair clamp described in this article was first designed, approved, and built for Principal J. W. Ray of our Erie East High School, former Northwestern Pennsylvania Tennis Champion, and adviser for ample space for the hands to work both above and below the head, and the thin edge of the metal engaging the frame leaves all of the holes open. This clamp was made by a machinist-trade boy at Tech High under the direction of Mr. H. L. Cotter. If it is desirable to build this clamp in the


TENNIS-RACKET CLAMP
For Repairing or Renewing Gut Strings.
⅜"-16 Tap
Knurl
(2) HAND NUT - 2 REQ'D MCH. STEEL
16 U.S. Std. Thds
(3) HANDLE-CLAMP BOLT 1 REQ'D. — MCH STEEL
16 U.S. Std. Thds
(6) HEAD-CLAMP BOLT 1 REQ'D. - MCH. STEEL
(4) HANDLE-CLAMP BRACE 1 REQ'D. - ¼" x 1" STL. BAR.
13/32" Drill
7/16 Drill - 2 Holes
(5) TIE BAR 1 REQ'D. - ¼" x 1¼" STL. BAR.
(1) HANDLE CLAMP 1 REQ'D ¼" x 1½" STL BAR
13/32" DRILL
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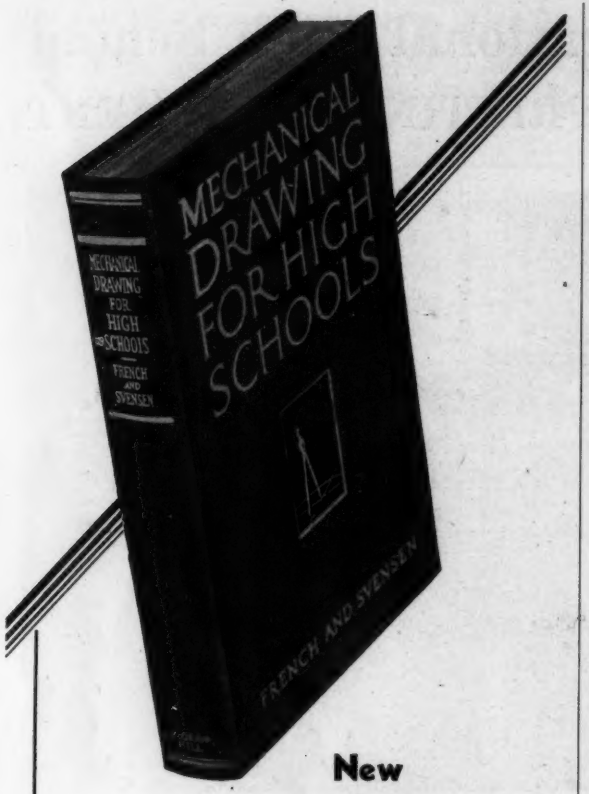

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Associations, Conventions

MICHIGAN INDUSTRIAL EDUCATION SOCIETY CONVENTION

The eighth annual meeting of the Michigan Industrial Education Society will be held April 25 to 27, in the Dearborn Inn, Dearborn, Mich.

President Harry Burnham promises a rousing convention, as all preliminaries have been carefully made.

Mr. F. E. Searle of the Ford Trade School will open the Thursday meeting with the address of welcome. Other speakers during the convention will be Mr. K. G. Smith, Assistant Supervisor of Industrial Education; Paul L. Cressman, Assistant Superintendent from the State Department of Public Instruction; Mr. O. L. Smith, Attorney-at-Law, Dearborn, Mich.; Dr. J. B. Edmonson, Dean of the School of Education, University of Michigan; Wm. J. Cameron, publicity director, Ford Motor Company, and others.

The theme for this year's convention will be "The Changing Conditions and the Future of Industry."

OKLAHOMA INDUSTRIAL-EDUCATION ASSOCIATION MEETS IN TULSA

The Industrial-Education Division of the Oklahoma Education Association held its annual meeting February 7–9, in Tulsa.

One session, in charge of DeWitt Hunt, of the Oklahoma A. and M. College, was devoted entirely to reports of research studies.

At the T. and I. meeting, with Mr. L. K. Covelle as chairman, Mr. W. M. Patterson talked on the subject, "The Federal Apprentice-Training Program and Its Effect on Oklahoma."

Professor Arthur B. Mays, of the University of Illinois, was the speaker at the vocational session.

On Friday noon there was a luncheon attended by 200 members of the home economics, vocational agriculture, and industrial groups. Professor Mays, was the speaker at this meeting. A number of round-table discussions followed.

The association elected the following officers and group chairman for the year 1935–36: Chairman, Claude Keenan, Oklahoma City; vice-chairman, W. A. Scott, Ponca City; secretary-treasurer, E. P. Chandler, Tulsa.

Members of Executive Committee: R. C. Browe, Oklahoma City, and H. A. Allender, Bristow; Group chairmen, trade and industry: L. K. Covelle, Stillwater; Research, DeWitt Hunt, Stillwater; Woodwork, J. C. Howard, Tulsa; General Shop, A. C. Miller, Stillwater; Electricity, auto mechanics, and machine shop, C. E. Gumm, Tulsa. — *E. P. Chandler.*

CENTRAL CONNECTICUT ASSOCIATION MEETS IN MERIDEN

The Central Connecticut Industrial-Arts Association held its spring meeting on March 30, in the Lincoln Junior High School, in Meriden. Mr. Eugene Giammatteo, of Bristol, acted as chairman of the meeting.

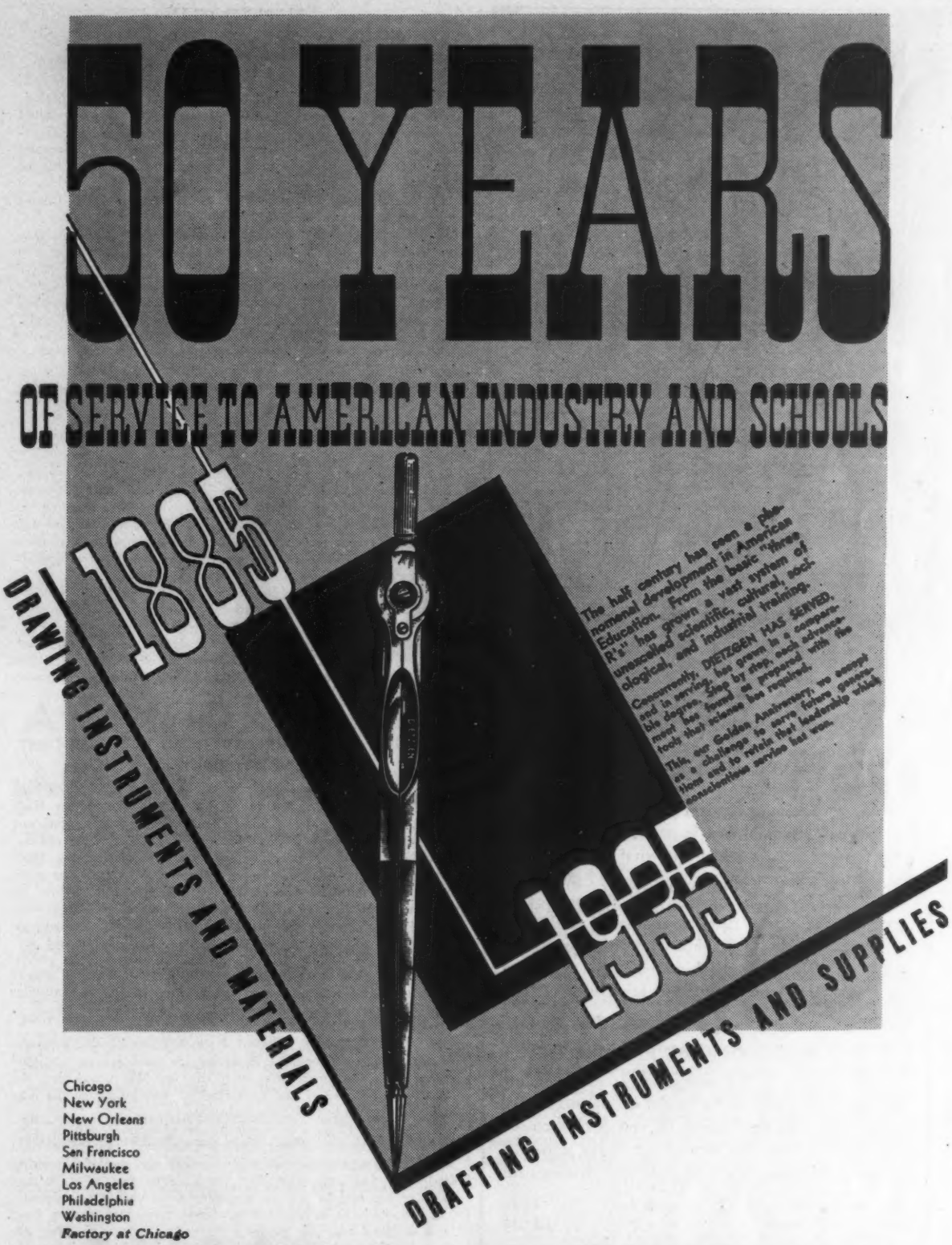
Supt. Nicholas Moseley, of Meriden, gave the address of welcome. Dr. Roy McLoughlin, the speaker, talked on the topic, "Industrial Arts the Basis of All Education for Boys." Mr. Harry E. Rollins, principal of the Lincoln School, proved to be an interesting speaker. John A. Backus, of the American Type Founders Company, told of visits to various parts of the country and of the increased activity in the work in all of the schools.

At the business meeting, which was in charge of Pres. William F. Moran, the group discussed the coming state meeting with superintendents. A motion was approved to hold one more meeting this year in May, with Bristol as the meeting place.

It was voted that steps be taken to co-operate with the New England Mechanical Drawing Association in the organization of a New England Association of Industrial Arts.

The following were elected honorary members: Supt. Stanley H. Holmes, New Britain; George J. Howe and Dr. G. E. Underhill, New Britain; Harry Wessell, New Britain; Wilson Greer, Wethersfield; Harvey R. Fuller, Wethersfield; Dr. Paul D. Collier, Hartford; Roger Thompson, Hartford; Dr. Nicholas Moseley, Meriden; Dr. Roy McLoughlin, and Harry E. Rollins, Meriden. — *Harry A. Barnicle.*

(Continued on page 10A)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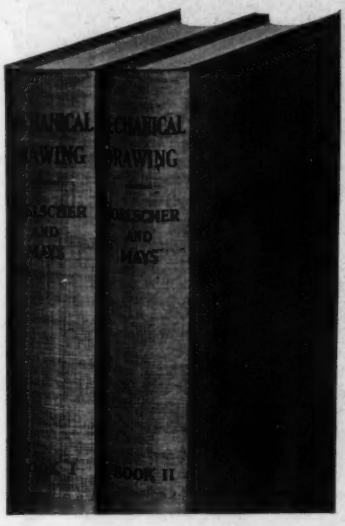

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(Continued from page 8A)

MEETING OF THE PEORIA INDUSTRIAL-EDUCATION CLUB

At the February meeting of this Club, Professor McIntosh, of The Bradley Institute, Peoria, Ill., was the principal speaker. In his talk on the subject "The Creation of a Picture," he pointed out that only that education which results in psychological reaction is real education. He demonstrated and presented examples of creative art. A question period was conducted at the close of the talk.

The March meeting was held at the clubhouse of the Illinois Valley Yacht and Canoe Club.

Mr. Ralph Atchinson, instructor in the Manual Training High School, Peoria, told of his experiences in metal spinning and his difficulties in working with copper, brass, and homemade equipment. Mr. Phil Becker, instructor at Bradley Polytechnic Institute, displayed a Paul Revere lantern said to be over 100 years old. Mr. Stephen Gilbert, instructor in the sheet-metal department of the Manual Training High School, outlined a list of material for use in a small sheet-metal shop. Mr. Harry Hurff talked on the subject "Antiques," and presented some interesting specimens. Probably the most interesting piece was an elaborate clock frame, said to be about 140 years old, from the first manual-training school in St. Petersburg, Russia. Mr. Wilbur Westhoff, woodworking instructor in the Peoria High School, displayed an example of a veneer picture made on a power jig saw. He discussed difficulties of gluing and showed examples of one-seam circular veneer table tops of butt walnut. Phil Graff, an instructor in the elementary schools, exhibited a variety of projects made from scrap material, and costing from five to ten cents. Mr. J. Deal, mechanical-drawing instructor in the Peoria High School, exhibited a series of graphs made in the mechanical-drawing classes from school-board data. Mr. Melvin Brye, woodworking instructor in the Roosevelt Junior High School, talked on the problem of getting a suitable project to be completed in ten-week periods, with six classes each day.

Mr. Fred Dace, head of the electrical department in Bradley Institute, showed some of his problems in electricity, using job sheets. The question of job sheets and their value was discussed by the group.—*F. L. Barloga.*

VOCATIONAL CONFERENCE HELD IN LYNDHURST, NEW JERSEY

The Bergen County Federation of Boards of Education held a vocational conference on January 30, in the Lyndhurst High School, Lyndhurst, N. J., which brought out many significant facts concerning the need for vocational education in the county.

Mr. Edward T. Marlatt, principal of the Hackensack High School, speaking on "Vocational Education," stressed the need for a vocational school in the county by presenting figures on maladjustment and retardation gathered from six large high schools in the country. He brought out that the high schools are not meeting the needs of the present day; that the present set-up in the high schools fails to reach a majority of the pupils. In order to meet the urgent need of a vocational school, it was suggested that a school be built by the county, with each district paying its pro rata share according to the number of pupils in attendance.

Mr. John T. Geaney, director of education and training for the Western Electric Company, discussed the need for a vocational school from the employer's point of view. He urged that the curriculum be devised and organized so that young people may make an easy transition into industry.

Dr. Wesley O'Leary, in presenting his ideas on vocational education from the state department's point of view, pointed out that in early times the apprenticeship system was used for training tradesmen and craftsmen. For the past quarter of a century industry has had to look to education for competent tradesmen. The schools have become too academic, consequently they have been designed only for pupils going on to college. Nothing was done for those who had normal ability and could not follow the regular academic curriculum. He stressed the fact that vocational schools have been organized to offer opportunities to nonacademic pupils to develop habits, skills, and attitudes toward industry and work.—*Charles Passiglia.*

(Continued on page 12A)

A DELTA INSTALLATION IN A LEADING CALIFORNIA JUNIOR HIGH SCHOOL—ANOTHER EXAMPLE OF THE RAPID SPREAD OF THE USE OF **DELTA** TOOLS FOR VOCATIONAL EDUCATION.

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(Continued from page 10A)

INDUSTRIAL-ARTS CLUB OF BERGEN COUNTY, NEW JERSEY

The Industrial-Arts Club of Bergen County, New Jersey, was organized three years ago by a small group of industrial-arts teachers who met regularly once a week for an extension course conducted by Mr. Robert Campbell, state supervisor of industrial arts. It was voted to form a club with the aims of uniting those teachers engaged in industrial-arts work in Bergen County into an organized body, of maintaining and promoting professional interest in industrial-arts work, of fostering social activities among the members of the association, and of offering a common meeting ground for the exchange of ideas concerning the work.

At the present time, approximately 85 per cent of the shopmen in the county are members of the club. The club, with the co-operation of the state department, has sponsored an extension course every year for the past four years, and is now making arrangements for an extension course to be offered this year. — *Charles Passiglia.*

N.E.A. TO MEET IN DENVER

Announcement has been made that the annual summer meeting of the National Education Association will be held from June 29 to July 5, at Denver, Colo.

The selection of Denver as a meeting place is very appropriate, since Denver is the heart of the world's great vacation land. Two national parks are located in Colorado and seventy-five miles south of Denver is the Colorado Springs region, famous for Pike's Peak and the Garden of the Gods. Near Cripple Creek is the one-time famous mining center of the state. Other sightseeing trips may be taken to the Mesa Verde, the land of the Aztecs, the homes of the cliff dwellers, and the world-famous million-dollar highway. Within easy walking distance of the city itself are various trips through the rock-walled canyons, to the lakes, and to the summits of peaks overlooking the city.

Complete information may be obtained from A. Helen Anderson, supervisor of publications for the Denver public schools.

CONNECTICUT SCHOOL OFFICIALS AND TEACHERS HOLD INDUSTRIAL-ARTS CONFERENCE

The Connecticut Industrial-Arts Association has completed arrangements for a conference on industrial arts for teachers, principals, and superintendents, to be held May 24 to 25, in the State Teachers' College, New Britain. Mr. Harry A. Barnicle, of Hartford, is chairman of the state conference committee in charge of the arrangements.

The conference has been called to consider the problem of industrial-arts teaching suitable for large numbers of young people who will return to school. It is recognized that the return of these young people will be worse than futile, unless some different type of program can be provided, and the conference will seek to determine what types of practical activity will be suitable to meet the situation, especially for pupils belonging to over-age groups.

At the conference, the schoolmen will discuss in group sessions such topics as (1) industrial arts the nucleus of education for nonacademically minded adolescents, (2) activities and equipment for industrial arts in secondary schools of cities of 10,000 population and upward, (3) industrial arts in smaller high schools having less than 300 pupils, (4) objectives and criteria for developing and evaluating programs for elementary schools, (5) objectives and criteria for developing and evaluating programs for secondary schools, (6) ways and means of contributing to the problems of youth and of adults, and (7) training teachers and supervisors for industrial-arts work. — *Harry A. Barnicle.*

Personal News

¶ Mr. Erwin L. Kletzien has been employed as a part-time instructor in the vocational school of La Crosse, Wis. Mr. Kletzien will have charge of the classes for young men and women who are unable to attend college and who are taking special work to fill in their leisure time.

¶ Mr. C. C. Personette, a member of the faculty of the vocational school of Racine, Wis., died at his home on March 12. Mr. Personette had been in charge of the electrical department of the school for the past eighteen years.

(Continued on page 13A)

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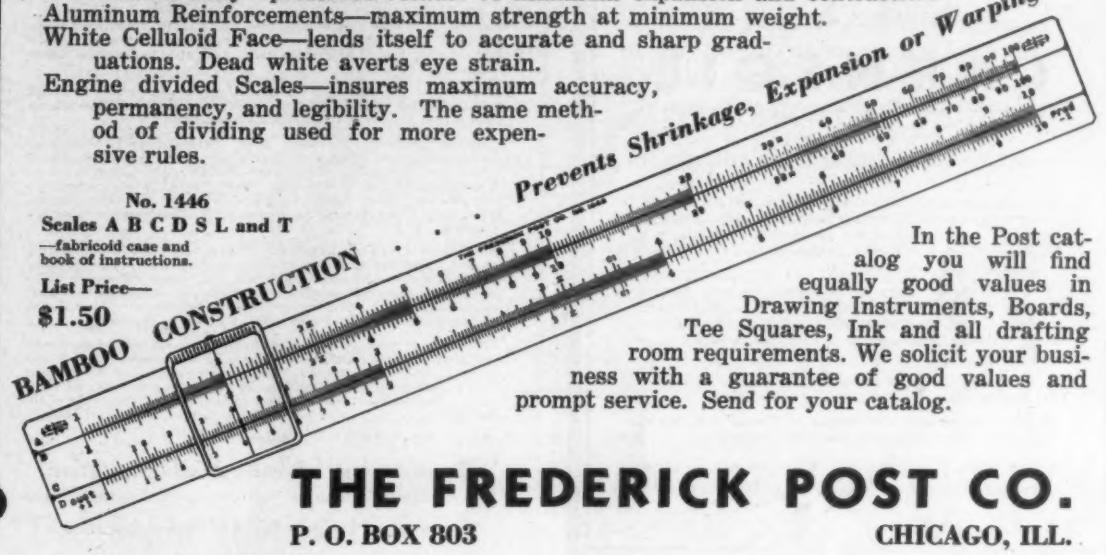

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(Continued from page 12A)

¶ Mr. Clarence H. Christopherson, until recently head of the industrial-arts department at Wakefield, Michigan, has been elected Instructor in Agricultural Engineering at the University of Minnesota. Mr. Christopherson earned a two-year diploma at Winona Teachers College and the bachelor's degree and master's degree at the University of Minnesota.

¶ Mr. Oscar L. Bunker, formerly of the Baldorioty Technical School, San Juan, Porto Rico, has recently been appointed Supervisor of Trade and Industrial Education for the Island of Porto Rico. Mr. Bunker received the bachelor of science degree at the University of Minnesota in the summer session of 1934.

¶ Mr. Harold Sohrbeck has been appointed Director of Industrial Arts for the East Moline public schools, at East Moline, Ill.

¶ Mr. Robert W. Williams was appointed Supervisor of Industrial Education of the Scranton public schools, Scranton, Pa.

¶ Mr. Charles N. Geisler was recently appointed Director of Vocational Education for the North Braddock public schools, North Braddock, Pa.

¶ Mr. E. L. Waltz is the newly appointed Supervisor of Industrial Arts for the Huntington public schools, Huntington, W. Va.

¶ Mr. John W. Deal, instructor in mechanical drawing in the high school, Peoria, Ill., received his master's degree from the State University of Iowa, where he majored in education.

¶ Mr. W. T. Bryan, former teacher of mechanical drawing in the senior high school, Springfield, Mo., has been given a teaching fellowship at Yale University. He is completing the work leading to a master's degree.

¶ R. L. Kilpatrick, a graduate student in industrial arts from the University of Missouri, is a teacher of woodwork in the School of the Ozarks, Hollister, Mo.

¶ W. K. Begeman has become assistant principal of the Hadley Vocational School at St. Louis, Mo.

¶ C. C. Clinger, a graduate of the State Teachers' College at Warrensburg, Mo., has become an instructor in the woodworking department for the State School of the Deaf.

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Director of Summer Session

The Stout Institute **Menomonie, Wisconsin**

Summer School News

Carnegie Institute of Technology, Pittsburgh, Pennsylvania

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Kansas State Teachers College, Pittsburg, Kansas

Summer session, June 3 to August 2.

The undergraduate work offered includes many courses in drawing and design, metal work, woodworking, printing, auto mechanics, finishing, upholstery, and applied electricity. Also professional courses dealing with organization, supervision, and the teaching of industrial-arts work will be given.

The graduate work includes studies in the field of industrial arts under the direction of eminent specialists.

Oregon State Teachers College, Corvallis, Oregon

First session, June 24 to August 2; second session, August 5 to August 30.

A large variety of shop courses together with courses on industrial-arts organization, trade analysis, teaching aids, shop problems, conference method, related and supplementary subjects, evening and continuation schools, administration, supervision, research, and graduate thesis will be offered.

University of Minnesota, Minneapolis, Minnesota

First term, June 17 to July 27; second term, July 27 to August 31.

For the first term, formal courses of training in adult education will be offered. Also courses in sociology, emergency education, child welfare, public health, physical education, play production, home economics, and music.

Bradley Polytechnic Institute, Peoria, Illinois

First term, June 17 to July 26; second term, July 27 to August 30.

Courses for teachers of industrial arts, home economics, and general school subjects will be offered.

The Stout Institute, Menomonie, Wisconsin

Summer session, June 24 to August 2.

The regular courses required for the B.S. degree in home economics and industrial arts will be offered, together with many short unit courses in these fields. Subject-matter courses in science, English, education, vocational education, home economics, and industrial arts will be given also.

Stout will offer for the first time this year, courses for the M.S. degree in home economics and industrial education.

Pennsylvania State College, State College, Pennsylvania

Intersession, June 11, 17 or 24 to June 28; main session, July 1 to August 9; postsession, August 12, 18 or 26 to 30.

The subjects for trade and industrial education and industrial-arts work will be offered during the main session. There are opportunities to make a choice of more than 400 courses, and over 200 graduate courses. Graduate work will be offered in industrial arts and vocational-industrial education.

Rhode Island School of Design, Providence, Rhode Island

Summer session, June 24 to July 26.

Courses in jewelry and metal work, studio painting, pottery and modeling, outdoor painting, craft weaving, creative design, costume design, costume construction, and lecture courses in appreciation of art will be given.

Cornell University, Ithaca, New York

Summer session, July 8 to August 16.

The graduate school of education in co-operation with the New York State Department of Education offers a series of courses for teachers of industrial arts and vocational education.

Mills College, Mills College, California

Summer session, June 24 to August 3.

Courses in industrial design, wood sculpture, painting, work with wood, glass, metal, textiles, and mosaics will be offered.

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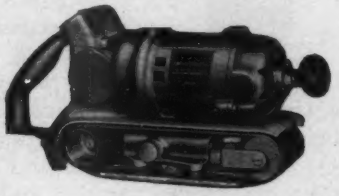
SchoolShopEquipmentNews

NEW AMERICAN SANDERPLANE

The American Floor Surfacing Machine Company, Toledo, Ohio, has announced its American Sanderplane No. 2, the latest in the line of portable, electric bench sanders for wood, metal, stone, and marble surfaces.



This sander is perfectly balanced so that it can be operated with one hand while cutting at maximum efficiency. A bench stand may also be obtained for this machine. The table on this stand is large enough to handle work of considerable size. The metal-sanding shoe is mounted on springs to give smooth operation, and all moving parts run in high-grade ball bearings.

Complete information is available upon request.

NEW OLIVER SINGLE SURFACE PLANER

The Oliver Machinery Company of Grand Rapids, Mich., has announced a new single-surface planer, No. 299, which will surface up to 24 in. wide and up to 8 in. thick at speeds ranging from 18 to 40 feet a minute.

The base is a single, massive, box-type casting. The planer is powered with a 5-h.p. motor on the cutter head and a 1-h.p. motor on the feed. The cutter head is a single casting amply strong to insure that the three tungsten-chromium high-speed steel knives will do their work with accuracy and smoothness. A knife-grinding and jointing device with micrometer adjustment is permanently mounted on the planer so that the utmost accuracy in preparing the knives is assured.

The magnetic control with push button is placed directly in front of, and within easy reach of the operator.

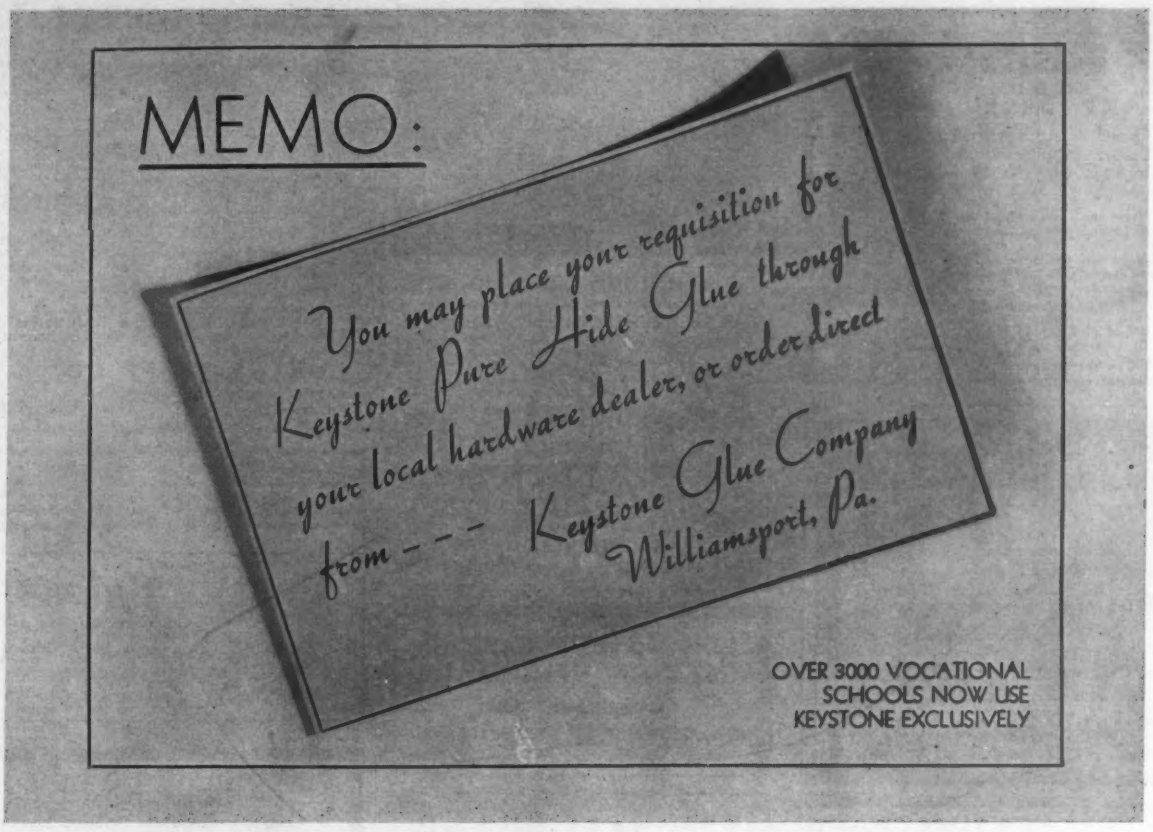
ANNOUNCE CHANGE IN PERSONNEL

Mr. Milford M. Hamlin, formerly connected with the engineering department of the American Type Founders Sales Corporation, Jersey City, N. J., has recently been appointed as educational representative for the Middle West territory of the firm. The appointment has been made because of a general expansion in the firm's business.

CHANGE OF ADDRESS

The Leathercraft Supply Company, who deals in leather, lacing, tools, etc., for the leathercrafter, have moved to 746 Mira Mar Avenue, Long Beach, Calif.

ADVERTISING PAGES REMOVED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News Notes

LIABILITY OF SCHOOL DISTRICTS

From California comes information about a case of the school district versus a high-school student enrolled in a shop course, who was injured while operating a hand jointer. The evidence showed that the injury was received while the boy was passing a cylindrical piece of wood 3 in. in length through the machine. It was also shown that the guard was in place, and that the student had received personal instruction from the instructor, and that a warning had been given him calling attention to the danger of running short pieces of wood through the machine. There also was a sign on the wall near the jointer, warning against attempting to plane pieces of wood less than 12 in. in length. The decision in this case was that the district was not held liable for the student's injury.

To Study Drawing Problems

Mr. Harvey W. Waffle, instructor in drawing in the High School, Waukesha, Wis., has been appointed chairman of a committee to study the problems of the drawing taught in schools. The other members of this committee acting for the drafting teachers belonging to the Wisconsin Industrial-Arts Association are: Roy Van Duzee of West Allis; R. R. Bedker of Wauwatosa; Leo Ebben of Kohler; G. A. Todd, Racine; and E. S. Lamoreaux of Janesville. The study will be carried on by the questionnaire method and will determine, first, the kinds of drawing being taught; second, the number of hours given by teachers to the different units of study; third, standard of practices used; fourth, measurements of achievement through the use of tests. The findings will be reported at the next annual meeting.

Summer Course for Teachers at General Motors

The General Motors Institute at Flint, Mich., is announcing the third annual summer course for teachers, to be held during a four-week period from July 1 to July 28.

The course has been continued this year because of the growing interest of undergraduates in the automobile industry and because of the need of providing teachers of automotive subjects with the benefits of practical experience in the field.

The course includes car specifications, instruction methods and procedures, service operations and equipment, trade and vocational-guidance information. Enrollment is open to any qualified teacher and to those of allied professions who may be designated by school authorities for such training. Tuition for the course is $25.

Hold National Hobby Show

The National Hobby Show will be held May 1 to 11, in Commerce Hall, Port Authority Building, in New York City. The show is being arranged under the direction of Mr. James S. Stanley, president of the Leisure League of America, Inc., and will comprise dramatic and spectacular projects relating to fifteen major classifications of hobbies, embracing several hundred distinct avocational and recreational possibilities and exemplifications.

Among the groups of related activities to be housed under one roof at the show are athletics, sports, and physical culture; community activities, the drama, and the dance; domestic arts and crafts; gardening; indoor games; lake and river activities; mechanical handicrafts; pets for pleasure and profit; photography; reading and writing; music; travel.

The displays will include exhibits by societies and associations devoted to the advancement of special leisure-time activities, together with exhibits of commercial companies of products relating to leisure and hobby interests.

A number of advisory organizations and institutions are planning to have displays of their work.

National Survey of Careers

The Institute for Research, Chicago, Ill., of which Dr. John A. Lapp is educational director, has completed a national survey of a number of interesting careers. The five careers studied by the survey committee include farm management, construction contracting, women's apparel, shop management, garage management, and beauty-parlor management. Monographs covering the results of these surveys will be published in a short time.

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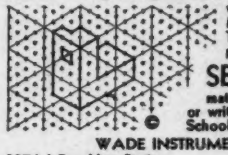

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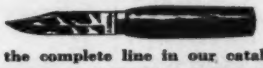

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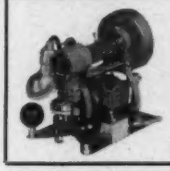

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